Ceres

Investing in the Clean Trillion:

CLOSING THE CLEAN ENERGY INVESTMENT GAP

A Ceres Report

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In order to limit global warming to 2 degrees Celsius and avoid the worst effects of climate change, "…investments in low-carbon energy technologies will need to at least double, reaching $500 billion annually by 2020, and then double again to $1 trillion by 2030."

— International Energy Agency (IEA) —
"Energy Technology Perspectives 2012"

ABOUT CERES

Ceres is a nonprofit organization mobilizing business and investor leadership on climate change, water scarcity and other sustainability challenges. Ceres directs the Investor Network on Climate Risk (INCR), a network of over 100 institutional investors with collective assets totaling more than $12 trillion. Ceres also directs Business for Innovative Climate & Energy Policy (BICEP), an advocacy coalition of nearly 30 businesses committed to working with policy makers to pass meaningful energy and climate legislation. For more information, visit http://www.ceres.org or follow on Twitter @CeresNews.

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In 2010 world governments agreed to limit the increase in global temperature to two degrees Celsius (2 °C) above pre-industrial levels to avoid the worst impacts of climate change.[1] To have an 80 percent chance of maintaining this 2 °C limit, the IEA estimates an additional $36 trillion in clean energy investment is needed through 2050—or an average of $1 trillion more per year compared to a "business as usual" scenario over the next 36 years.[2]

These new investments in clean energy—including renewable energy such as solar, wind and geothermal, energy efficiency and energy smart technologies such as power storage, fuel cells and carbon capture and storage—will provide multiple benefits. In addition to cutting greenhouse gas emissions in half by 2050, such investment will yield significant returns in the form of reduced fuel costs. Total fuel savings are an estimated $100 trillion between 2010 and 2050.[3] Moreover, the greater job-creation potential of energy efficiency and renewable energy relative to fossil fuels makes clear that quadrupling annual global investment in clean energy will create millions of new jobs worldwide.

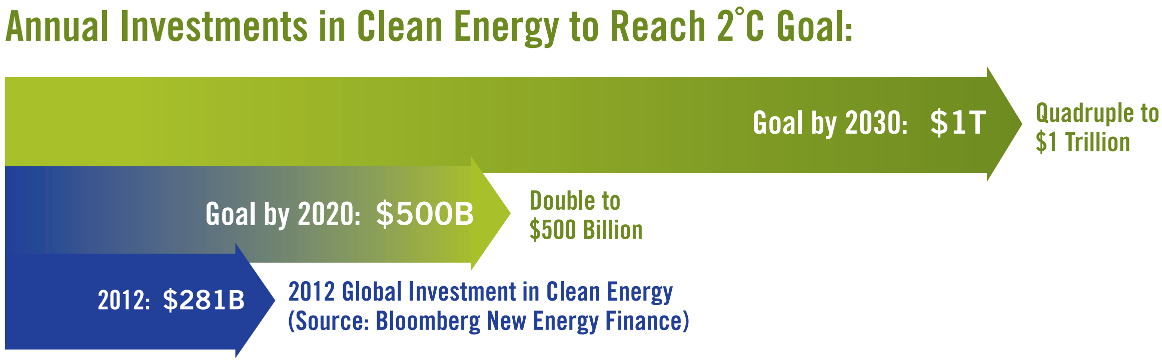
1 For more information, visit UN Framework Convention on Climate Change (UNFCCC): http://unfccc.int/key_steps/cancun_agreements/items/6132.php

2 International Energy Agency (IEA), *Energy Technology Perspectives 2012: Pathways to a Clean Energy System*, (Paris: OECD/IEA, 2012), 1, http://www.iea.org/Textbase/npsum/ETP2012SUM.pdf

3 Assuming a 10% discount rate, such savings have a present value of $5 trillion. IEA, *Energy Technology Perspectives* 2012, 147.

This paper refers to the necessary additional investment in clean energy as the "Clean Trillion." Current annual investment in clean energy falls far short of this goal. In 2012, global investment in clean energy (as defined by Bloomberg New Energy Finance) was $281 billion—and in 2013 this figure is expected to be even lower.[4] Simply put, there is a clean energy investment gap.

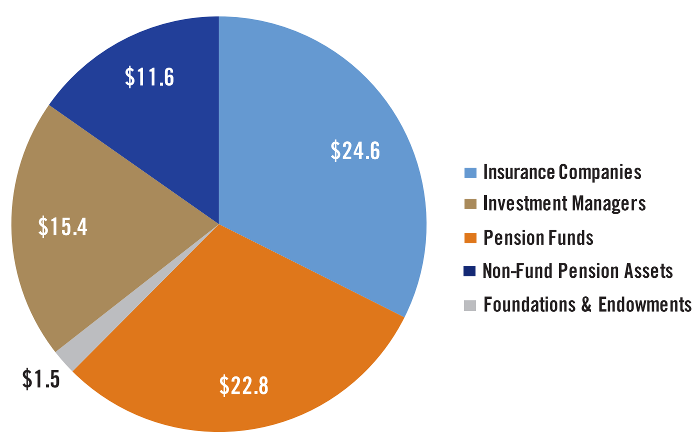
FIGURE 1: THE CLEAN ENERGY INVESTMENT GAP



CLOSING THE GAP BY MOBILIZING INSTITUTIONAL INVESTMENT IN CLEAN ENERGY

Today's leading providers of capital to clean energy are primarily commercial banks, national and multilateral development banks and electric utilities. But these sources alone are insufficient to double annual global clean energy investment by 2020 and quadruple it by 2030. Clean energy projects need new and additional sources of capital, and the largest potential providers are institutional investors such as pension funds, insurance companies, sovereign wealth funds, endowments, foundations and investment managers. Globally, these institutional investors collectively manage about $75.9 trillion in assets.[5]

FIGURE 2: TOTAL ASSETS BY TYPE OF INSTITUTIONAL INVESTOR (IN TRILLIONS OF 2010 USD) GLOBAL TOTAL OF $75.9 TRILLION



Note: Excludes $3.9 trillion of assets held by sovereign wealth funds. Figures above have adjusted for double-counting by reducing assets of investment managers by $15 trillion (i.e. to account for pension insurance contracts and pension assets potentially invested in mutual funds, ETFs, hedge funds and private equity funds). Of this total, analysts estimate roughly $45 trillion to be assets devoted to long-term investment.

Source: Climate Policy Initiative (2013), based on data from OECD. Stat Insurance Statistics, OECD. Stat Pension Statistics, TheCityUK (2011a and 2012a), Investment Company Institute, Sovereign Wealth Fund Institute, McKinsey Global Institute (2011).

4 Bloomberg New Energy Finance (BNEF), *Global Trends in Clean Energy Investment*, October 14, 2013, 28, http://about.bnef.com/fact-packs/global-trends-in-clean-energy-investment-q3-2013/. For discussion of differences between BNEF numbers on actual investment and IEA projections of required investment, see Appendix C of the full paper.

5 Climate Policy Initiative (CPI), *The Challenge of Institutional Investment in Renewable Energy*, March 2013, 7, http://climatepolicyinitiative.org/wp-content/uploads/2013/03/The-Challenge-of-Institutional-Investment-in-Renewable-Energy.pdf

Current clean energy investment levels by these institutional investors are quite low, especially in regard to equity and debt for asset finance, a key lifeblood for clean energy infrastructure projects. The most recent annual *OECD Large Pension Fund Survey* found that less than 1 percent of institutional investor assets were allocated to infrastructure projects—and an even smaller share (~0.1 percent) was allocated to clean energy infrastructure projects (investors can, in fact, make investments either directly or through other vehicles in infrastructure projects).[6] Analysts calculated that from 2004-2011, only $22 billion of asset finance for clean energy came from pension funds and insurance companies—or less than 2.5 percent of total clean energy asset finance globally over this period.[7]

Boosting these capital allocations to clean energy is essential to meeting the "Clean Trillion" goal of doubling annual global clean energy investment by 2020 and hitting $1 trillion per year by 2030. Elevating these levels, however, requires that key institutional investor considerations be met: investments must provide competitive risk-adjusted returns that suit their varying risk preferences, regulatory requirements and credit/liquidity constraints; they also must align with their long-term fiduciary duty to their beneficiaries.

Still, global clean energy opportunities are timely and potentially vast, especially as many pension funds seek to boost their infrastructure allocations. The Climate Policy Initiative estimated last year that more than $800 billion of institutional capital is available for investment in renewable energy projects. Bloomberg New Energy Finance is forecasting a potential clean energy bond market of $142 billion, with bond issuances of $18-$40 billion annually, up from roughly $2 billion a year today. More insurance companies and pension funds are already buying up ownership stakes and securitized debt in large-scale renewable energy projects.

INVESTING IN CLEAN ENERGY CAN IMPROVE DIVERSIFICATION & MITIGATE RISK

Increasing investment in clean energy has the potential to yield two major benefits for investor portfolios. The first benefit is the potential to diversify investments and potentially improve portfolio performance. This applies especially to investment in clean energy infrastructure vehicles, whether via debt or equity. Such investments offer stable cash flows that have low volatility, low correlation to other assets, and often are indexed to inflation.

The second benefit is to minimize exposure to climate risk—including both physical risk and carbon asset risk. According to the IEA, more than two-thirds of the world's proven reserves of fossil fuels will be unusable prior to 2050 if necessary carbon regulations are enacted to limit global temperature increases to 2˚C.[8] The next wave of fossil fuel investment, potentially as much as $7 trillion in the next decade alone,[9] may lead to stranded fossil fuel assets that erode long-term shareholder value.[10]

Current and future action to mitigate climate change and improve energy efficiency will strongly affect the valuations of fossil fuel companies—perhaps by as much as 60-80 percent[11]—and is already happening with U.S. coal companies whose valuations have dropped dramatically since 2011. Even companies not directly engaged in fossil fuel production or fossil fuel power generation could be negatively affected.

6 Kaminker, C. et al., "Institutional Investors and Green Infrastructure Investments: Selected Case Studies," *OECD Working Papers on Finance, Insurance and Private Pensions*, No. 35, OECD Publishing, 2013, http://www.oecd-ilibrary.org/finance-and-investment/institutional-investors-and-green-infrastructure-investments_5k3xr8k6jb0n-en.

7 Kaminker C. and F. Stewart, "The Role of Institutional Investors in Financing Clean Energy," *OECD Working Papers on Finance, Insurance and Private Pensions*, No. 23, OECD Publishing, 2012, 20-22, http://www.oecd.org/environment/WP_23_TheRoleOfInstitutionalInvestorsInFinancingCleanEnergy.pdf

8 IEA, *World Energy Outlook 2012*, (Paris: OECD/IEA, 2012), 34-35.

9 Assuming that over the coming decade annual upstream capital investment in fossil fuels is at least equal to the IEA's 2012 estimate for upstream oil and gas capital investment of nearly $700 billion.

10 CarbonTracker and the Grantham Research Institute, *Unburnable Carbon 2013: Wasted Capital and Stranded Assets*, 2013, http://www.carbontracker.org/wastedcapital. Generation Foundation, *Stranded Carbon Assets: Why and How Carbon Risks Should Be Incorporated in Investment Analysis*, October 30 2013, http://genfound.org/library/.

11 HSBC Global Research, *Oil & Carbon Revisited—Value at Risk from 'Unburnable' Reserves*, January 25 2013.

As the investment consultancy Mercer has noted, certain climate-sensitive investments, particularly those that promote a low-carbon future, may reduce overall portfolio risk, creating "the prospect that institutional investors' interests can be aligned to both serve their beneficiaries' financial interests as well as help tackle the wider challenge of climate change by increasing investment in mitigation and adaptation efforts globally."[12]

It is in the collective interests of institutional investors to mitigate the substantial systemic economic risks posed by climate change, and investing in the necessary transition to a low-carbon, clean energy economy helps mitigate these risks.

KEY RECOMMENDATIONS

Drawing on an extensive review of published research and discussion with leading investors and clean energy practitioners, this paper outlines 10 recommendations for investors, companies and policymakers to create a landscape to achieve the interim goal of doubling annual clean energy investment by 2020, and to build the foundation for achieving the "Clean Trillion"—at least $1 trillion in annual investment in clean energy by 2030.

Our primary audience for the paper is institutional investors, but it is also directed at electric utilities, large companies, utility and financial regulators, and policymakers. Most of the recommendations are direct investor activities, but several encourage companies, regulators and policymakers to pursue necessary policies and actions to accelerate clean energy investment.

We acknowledge at the outset that each investor has specific mandates, risk-return requirements and investment processes, and that the recommendations must be implemented in the context of these requirements.

The 10 recommendations fall into three categories. Below we highlight how each impacts the risk and return characteristics of portfolio investments:

MOBILIZE INVESTOR ACTION TO SCALE UP CLEAN ENERGY INVESTMENT

1. *Develop capacity to boost clean energy investments and consider setting a goal such as 5 percent portfolio-wide clean energy investments*

The heightened commitment resulting from a portfolio-wide goal would give investors the best chance of capitalizing on new clean energy-related opportunities across all asset classes, especially fixed income, as opposed to relegating this clean energy theme to just public equity or venture capital. Bolstering internal and external capacity for increased infrastructure investment, both directly and through other vehicles, will strengthen the potential to pair the necessary cash flows of clean energy infrastructure assets with investor liabilities and funding requirements.

2. *Elevate scrutiny of fossil fuel companies' potential carbon asset risk exposure*

In a 2011 report, Mercer warned that climate-related government policies could increase portfolio risks by 10 percent over the next 20 years. The potential for reduced demand for fossil fuels driven by non-policy factors such as increased renewable energy, energy efficiency and fuel switching, also creates risks for investors who own fossil fuel companies. Investors should be paying increased attention to carbon asset risks by engaging with fossil fuel firms, including oil and coal companies, on the potential of higher cost, carbon-intensive fossil fuel reserves becoming "stranded," thus creating long-term portfolio risks.

12 Mercer, *Climate Change Scenarios—Implications for Strategic Asset Allocation*, February 15, 2011, 9, http://www.mercer.com/articles/1406410.

3. Engage portfolio companies on the business case for energy efficiency and renewable energy sourcing, as well as on the financing vehicles to support such efforts

Encouraging companies to aggressively pursue energy efficiency opportunities can help unlock projects with high returns, thereby creating shareholder value. By using more clean energy resources to reduce fossil fuel dependency and carbon emissions, companies will: 1) reduce vulnerability to volatile fossil fuel prices; 2) reduce exposure to future carbon regulations; and 3) identify new potential low-carbon business opportunities and customer solutions, leading to new revenues. All of these benefits underpin academic research showing that, over the long term, companies with leading environmental performance also deliver superior financial returns for investors.[13]

4. Support efforts to standardize and quantify clean energy investment data and products to improve market transparency

Standardizing definitions of key investment terms, such as what constitutes a "climate bond," will minimize the due diligence burden on investors and reduce transaction costs of investing in newer clean energy-related investment products. By reassuring potential buyers about what they are purchasing, standardization will also increase the liquidity of climate bonds and other products. Ultimately, better data on clean energy investment will foster easier, more precise benchmarking evaluation of potential deals.

PROMOTE GREEN BANKING AND DEBT CAPITAL MARKETS

5. Encourage "green banking" to maximize private capital flows into clean energy

Expanded issuance of climate bonds by multilateral banks will broaden the universe of highly-rated fixed-income products attached to clean energy, thereby making it easier for investors to increase allocations to clean energy within existing liquidity/creditworthiness constraints. Investment-grade credit ratings for project bonds, such as S&P's recent approval of SolarCity bonds, will enable investors to capture the relatively higher yield of these instruments, especially relative to sovereign debt. The $2.5 trillion covered bond market offers attractive products for pension funds and insurers—extra yield relative to sovereign debt, but with less risk than unsecured bank debt or asset-backed securities—and expanding this market into clean energy will increase such opportunities.

6. Support issuances of asset-backed securities to expand debt financing for clean energy projects

Asset-backed securities (ABS) for energy efficiency and renewable energy projects offer long-term, low-volatility yields that match well with the liabilities of insurers and pension funds. To reach a scale that is attractive to these investors, however, this market must overcome growing pains that are common to any new capital markets product. Key steps for achieving scale include: 1) minimize the due diligence burden on buyers of clean energy issues by standardizing terms for power purchase agreements; 2) make future cash flows from such issues more stable; 3) enable more accurate rating and pricing of such issues by providing more detailed historical data; and 4) limit downside risk for buyers of early clean energy ABS issues through credit enhancement by public or private banks.

7. Support development bank finance and technical assistance for emerging economies

Expanded risk insurance for clean energy investments in developing countries removes a key red flag on otherwise attractive investments. More generally, one of the ancillary benefits from helping emerging economies to embrace a low-carbon future may be significant new investment opportunities for foreign sources of capital. It's worth noting that development bank financing creates $3-15 of private investment opportunity for every $1 of public funds deployed.[14]

13 DB Climate Change Advisors, *Sustainable Investing: Establishing Long-Term Value and Performance*, May 2012, https://www.dbadvisors.com/content/_media/Sustainable_Investing_2012.pdf

14 UNEP/SEFI, *Public Finance Mechanisms to Mobilise Investment in Climate Change Mitigation*, 2008, http://fs-unep-centre.org/sites/default/files/media/uneppublicfinancereport.pdf

REFORM CLIMATE, ENERGY AND FINANCIAL POLICIES

8. Support regulatory reforms to electric utility business models to accelerate deployment of clean energy sources and technologies

With a combined enterprise value of trillions of dollars, relatively low volatility and predictable earnings, the debt and equity of electric utilities have long been a significant share of institutional investor portfolios. But many trends are eroding the viability of traditional utility business models, which have long been premised on selling more power rather than helping ratepayers use less electricity. As stewards of trillions of dollars of capital, investors have a strong interest in ensuring that electric utilities remain financially viable in a changing landscape, where energy efficiency and distributed renewable energy are becoming bigger factors. Supporting utilities' transition to new, more sustainable business models will preserve the electric utility sector as a viable place for investors to put their capital to work.

9. Support government policies that result in a strong price on carbon pollution from fossil fuels and phase out fossil fuel subsidies

Climate change has the potential to harm long-term investor returns via 1) physical impacts, such as rising sea levels and more pronounced storms and heat waves, which can severely damage individual companies and entire economies;[15] and 2) the implementation of policies to reduce carbon emissions, which, especially if delayed for another decade or so, may come as a drastic and abrupt shock to company business models and economies at large. Adoption of economy-wide carbon prices now helps to prevent both of these risks, and enables investors to plan prudently for the transition to a low-carbon global economy. More broadly, the adoption of carbon prices and removal of fossil fuel subsidies will create supportive tailwinds across all asset classes for low-carbon investments and headwinds for high-carbon investments such as oil, gas and coal production.

10. Support policies to de-risk clean energy deployment

Policies that provide stable, long-term cash flows to clean energy projects that do not depend on unreliable and often complicated tax incentives will make clean energy significantly more attractive to institutional investors, especially as clean energy technologies approach cost competitiveness. Moreover, a focus on large-scale deployment will create investment opportunities of the size necessary for investors to justify building expertise in this new area. Finally, the lower project costs that come with increased clean energy deployment will stimulate more investment opportunities potentially worth trillions of dollars.

15 Stern, N. Nicholas Herbert, ed. *The Economics of Climate Change: the Stern Review.* Cambridge University Press, 2007.

Introduction

Climate change poses significant risks to the global and regional economies and to the portfolios of institutional investors that depend on economic stability and growth. Mitigating climate change is in the economic interests of investors, both to reduce systemic risks to their portfolios and to capture new investment opportunities in the necessary transition to a low-carbon, clean energy economy.

Our primary audience for the paper is institutional investors, but it is also directed at electric utilities, large companies, utility and financial regulators, and policymakers.… We acknowledge that each investor has specific mandates, risk-return requirements and investment processes.

Drawing on an extensive review of published research and discussions with practitioners and thought leaders in clean energy, this paper outlines 10 recommendations to increase global investment in clean energy at the scale necessary to avert severe climate change impacts. Our primary audience for the paper is institutional investors, but it is also directed at electric utilities, large companies, utility and financial regulators, and policymakers. Most of the recommendations are direct investor activities, but several call for encouraging companies, regulators and policymakers to pursue necessary policies and actions to accelerate clean energy investment. We acknowledge that each investor has specific mandates, risk-return requirements and investment processes, and that these recommendations must be implemented in the context of these requirements. In this respect, investment consultants, key advisers to virtually all institutional investors, are another important audience for the paper's recommendations.

To prevent the worst impacts of climate change, there must be substantially more investment in clean energy technologies globally. In 2010 governments from 193 nations agreed to limit the increase in global average temperature to 2 degrees Celsius (2 °C) above pre-industrial levels.[1] To secure an 80 percent chance of maintaining this 2 °C limit, the International Energy Agency (IEA) estimates that an additional $36 trillion in clean energy investment is needed through 2050—or roughly $1 trillion more each year over the next 36 years relative to a "business as usual" extension of current trends.[2] If these additional investments are not made and current pollution trends continue, the expected increase in global temperatures is likely to reach a level that the World Bank and most climate scientists agree would have dire implications for the global environment, the global economy and human society.[3]

This $36 trillion of additional investment is 35 percent more than the world would invest in energy infrastructure by 2050 in any event—or about $140 trillion overall, versus $104 trillion if higher-polluting current investment trends continue.[4] The IEA notes that extra investments in clean energy—including renewable energy such as solar, wind and geothermal, energy efficiency and energy smart technologies such as power storage, fuel cells and carbon capture and storage (CCS)—will have dual benefits. In addition to cutting greenhouse gas emissions in half by 2050, such investment will yield an impressive return in the form of reduced fuel savings. Between 2010 and 2050 net fuel savings are estimated to be $60 trillion (or an average of $1.5 trillion annually);

1 UN Framework Convention on Climate Change (UNFCCC): http://unfccc.int/key_steps/cancun_agreements/items/6132.php

2 International Energy Agency (IEA), *Energy Technology Perspectives 2012: Pathways to a Clean Energy System*, (Paris: OECD/IEA, 2012), 8, 31, http://www.iea.org/Textbase/npsum/ETP2012SUM.pdf. The IEA's 2 °C scenario (2DS) describes an energy system "consistent with an emissions trajectory that recent climate science research indicates would give an 80 percent chance of limiting average global temperature increase to 2°C. It sets the target of cutting energy-related CO2 emissions by more than half in 2050 (compared with 2009) and ensuring that they continue to fall thereafter." Conversely, the IEA's baseline scenario—where controlling carbon emissions is not a priority, and which largely reflects current trends—sees total greenhouse gas emissions more than double through 2050 and average global temperature increase by at least 6 °C (6DS). Relative to the scenarios in the IEA's 2013 World Energy Outlook, the 2DS is broadly consistent with the 450 Scenario (i.e. 450 parts per million atmospheric concentration of CO2) and the 6DS is broadly consistent with the Current Policy Scenario.

3 Stern, N. Nicholas Herbert, ed. *The Economics of Climate Change: the Stern Review*. Cambridge University Press, 2007.

4 IEA, *Energy Technology Perspectives 2012*, 8, 35.

assuming a 10 percent discount rate, such savings have a present value of $5 trillion and highlight the affordability of moving to a low-carbon energy sector.[5] Moreover, though not explicitly called out by the IEA, the greater job-creation impacts of energy efficiency and renewable energy relative to fossil fuels suggests that mobilizing "Clean Trillion" levels of investment will create millions of new jobs throughout the world. (For more discussion of clean energy and jobs, see the "Clean Energy and Jobs" text box and Appendix A.)

This paper provides 10 recommendations to create an environment that achieves the interim goal of doubling annual clean energy investment by 2020, and to build the foundation for achieving the "Clean Trillion" by 2030.

This paper refers to this additional investment as the "Clean Trillion," an annualized goal that is still a decade or more away from becoming a reality. In 2012, global investment in clean energy technologies (as defined by Bloomberg New Energy Finance) was $281 billion[6], and in 2013 that amount will likely be lower—far short of the amount needed to keep the climate on a 2 °C pathway.

Turning the "Clean Trillion" into a reality, however, will be a tremendous challenge, requiring a combination of 1) comprehensive government policies that incentivize clean energy and fully price higher-polluting technologies and; 2) wide-ranging changes to investment practices and financing vehicles that will attract substantially more institutional investor capital. This latter category is the primary focus of this paper.

Put simply, clean energy projects need new sources of investment capital if they are to scale faster. It is especially critical that allocations from institutional investors—such as public and private pension funds, insurance companies, foundations, endowments and mutual funds—increase dramatically. For example, as of 2012 their cumulative assets of over $75 trillion accounted for only a tiny share—anywhere from .1 percent to 2.5 percent—of the $90 billion in global asset financing for clean energy projects. These investments do not have to be direct but can be also made using other vehicles. Indeed, it is quite likely that these other investment vehicles, particularly securitized bonds, if developed aggressively could prove the most significant source of capital. Significantly boosting these allocations requires investments that achieve adequate risk-adjusted returns as well as alignment with institutional investors' long-term fiduciary duty to their beneficiaries and clients. Approaches outlined in this paper seek to fulfill those criteria.

This paper provides 10 recommendations for investors, companies and policymakers to create an environment that achieves the interim goal of doubling annual clean energy investment by 2020, and to build the foundation for achieving the "Clean Trillion" by 2030. It focuses primarily on the critical role that institutional investors can play in making and facilitating these investments—increasing both the global supply of and demand for cost-effective clean energy investments. It also calls on other key capital market players—electric power companies, banks, regulators and policymakers—to do their part. Achieving this goal provides tremendous investment opportunities and can be consistent with investors' fiduciary duty to protect investment returns for present and future beneficiaries.

5 IEA, *Energy Technology Perspectives 2012*, 38.

6 Bloomberg New Energy Finance (BNEF), *Global Trends in Clean Energy Investment*, October 14, 2013, 28, http://about.bnef.com/fact-packs/global-trends-in-clean-energy-investment-q3-2013/.

CLEAN ENERGY AND JOBS

In addition to a safer planet, cleaner air and trillions of dollars in fuel savings, realizing "Clean Trillion" levels of investment will yield another benefit: millions of new jobs. Five years after the 2008-2009 financial crisis, the global economy continues to produce far too few jobs and even fewer decent-paying jobs. Achieving the "Clean Trillion" can help to remedy this situation. The points below articulate key elements of the clean energy-jobs connection.

- ***Clean energy sources are more job-intensive than fossil fuels:*** Focusing on the power sector, clean technologies create 2 to 8 times more "job years per gigawatt-hour (GWh)"[7] than fossil energy sources—specifically, 0.4 job years per GWh for energy efficiency and 0.85 job years per GWh for solar PV versus less than 0.2 job years per GWh for coal and natural gas.[8]
- ***Deployment of clean energy sources can create a huge number of new jobs:*** A 2012 study, for example, considered the job-creation impacts for the U.S. from widespread investment in renewable energy, energy efficiency and natural gas-fired generation at the expense of coal-fired generation.[9] Through 2030, these cleaner investments yielded an additional *7.9 million cumulative net job-years* of direct and indirect employment, and *486,000 net new jobs* in place in 2030 compared with the start in 2010. Dozens of other studies have confirmed the large potential for creating new jobs through investment in clean energy (for a review of these studies, see Appendix A).
- ***Clean energy sources create good jobs:*** The study above estimated new jobs for a wide range of occupations, including well-paid jobs in construction, manufacturing, engineering and related professional services. Workers of all skill levels and educational backgrounds can benefit from the clean energy economy.
- ***Need for a "just transition:"*** The move towards a low-carbon economy, however, will likely create economic dislocation and job losses in fossil fuel industries. Companies and policymakers must plan and execute programs to assist and retrain workers left behind by the transition to cleaner energy sources. The transition to a low-carbon economy must be a just one that minimizes creation of "stranded people."

Rather than viewing our needs for new jobs and new energy sources as two separate challenges, businesses, governments and society should recognize the overlap between these issues and accelerate solutions (such as deployment of clean energy sources) that can make progress on both fronts.[10]

Clean energy sources are more job-intensive than fossil fuels: Focusing on the power sector, clean technologies create 2 to 8 times more "job years per gigawatt-hour" than fossil energy sources.

7 A job-year of employment is defined as full-time employment for one person during one year (measured by a standard 2,080 hrs of employment/year). A gigawatt-hour is equal to one billion watt-hours, or roughly the amount of electricity that a typical nuclear power plant generates during one hour of operation.

8 Wei, M., Patadia, S., and D. Kammen,"Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the U.S.?," *Energy Policy*, 38 (2010) 919-931.

9 DB Climate Change Advisors, *Repowering America: Creating Jobs*, October 2011, https://www.db.com/cr/en/docs/DB_Repowering_America_Creating_Jobs.pdf

10 International Labour Organization (ILO), *Sustainable Development, Decent Work, Green Jobs*, March 15 2013, http://www.ilo.org/ilc/ILCSessions/102/reports/reports-submitted/WCMS_207370/lang—en/index.htm

The Global Clean Energy Investment Landscape

CLEAN ENERGY ASSET CLASSES

Global clean energy investment includes a wide range of sectors from renewable electricity generation to energy efficiency services to electric vehicles. It also encompasses a range of different *asset classes*, including public and private equity, fixed income (debt), real estate and infrastructure. Broadly speaking, clean energy investment can be sub-divided into two categories: investment in infrastructure *projects* directly or through other vehicles and investment in companies. Each of these *categories* then has two sub-categories, as the paragraphs below explain (note that this discussion draws on the taxonomy of Bloomberg New Energy Finance, and is not the only classification system for clean energy investment).[11]

Investment in infrastructure projects: Large renewable asset finance and small distributed generation capacity finance

These investments, which can be direct or through other vehicles, are generally called *asset finance* and finance construction of renewable energy plants, biofuel plants, carbon capture and storage (CCS) plants, power storage projects and other related infrastructure. Asset financing comes in different forms, including financial arrangements specific to individual projects (e.g. non-recourse loans from project finance structures, commercial and other bank debt, securitized bonds) and also from utilities via their balance sheets. In the case of residential and commercial-scale rooftop solar PV projects, such investments are typically called *distributed generation capacity finance*. Financing for small-distributed generation comes from a combination of bank debt, private equity, and, in the U.S., monetization of the Investment Production Tax Credit (i.e. "tax equity"). This paper covers both categories of infrastructure project investment under the broad theme of clean energy *infrastructure*.

Investment in companies: Public markets and venture capital/private equity

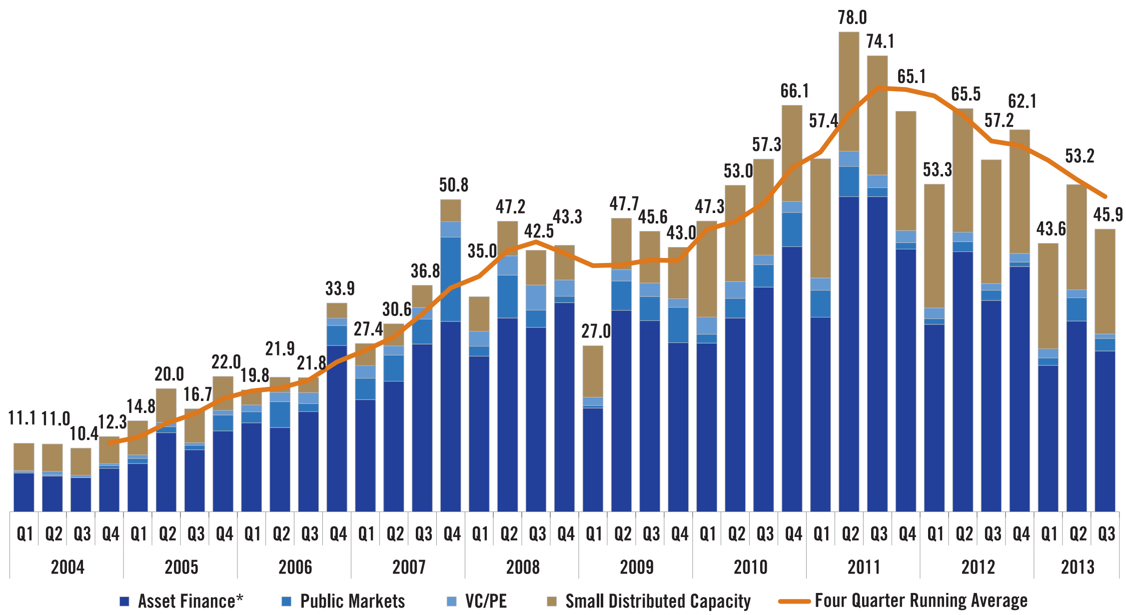
A second category of clean energy investment involves supplying equity to companies active in pure-play clean energy (e.g. solar, advanced vehicle technology, clean fuels) or CCS.[12] One way this occurs is when companies raise new equity through the *public capital markets* (e.g. initial public offerings). Companies (typically younger, smaller companies) can also raise new equity through transactions with private investors such as early-stage venture capital (VC) or later-stage private equity (PE) firms.

11 For more discussion, see Appendix B.

12 Other routes for public markets investment in clean energy include investment in corporate bonds of pure-play clean energy or CCS companies, as well as (to a lesser extent) in the equity or debt of electric utility or diversified industrial companies that are active in clean energy. Though currently excluded from BNEF data (since, for example, pure-play clean energy companies as a whole have relatively little debt), going forward corporate bonds are likely to play a greater role in financing the activities of clean energy companies. Similarly, utility and diversified companies (as opposed to pure-play companies) are likely to account for a larger share of overall clean energy investment.

Figure 3 illustrates how investment in infrastructure (via asset finance and small distributed capacity) has dominated overall clean energy investment globally, accounting for more than 90 percent of combined total investment across all asset classes (with $165 billion of asset finance accounting for the majority of this 90 percent share).[13] Moreover, were these figures to include asset finance of energy efficiency building retrofits, industry process improvements and advanced transportation, the size of overall clean energy infrastructure investment would increase further.

FIGURE 3: NEW INVESTMENT IN CLEAN ENERGY BY ASSET CLASS, Q12004 - Q32013 (IN $BILLIONS)



Source: Bloomberg New Energy Finance. Excludes corporate/government R&D. Asset finance numbers include renewable power (e.g. wind, solar, etc.), biofuels, and CCS, but exclude asset finance for building/industry efficiency, advanced transportation, hydrogen, and fuel cells.

DEFINING THE CLEAN TRILLION

Understanding differences between IEA and BNEF definitions

Measuring annual levels of clean energy investment is challenging due to differing methodologies used by the International Energy Agency (IEA), Bloomberg New Energy Finance (BNEF) and the Climate Policy Initiative (CPI).

A key foundation for the paper is the IEA's figures. The IEA states that in order to have an 80 percent chance of limiting global average temperature increases to 2 °C, there needs to be roughly $1 trillion of additional investment in clean energy each year through 2050 (compared to what would be invested under a scenario where future global average temperatures increase by 6 °C)—or $36 trillion overall by 2050.[14] Investment activities that IEA includes in measuring this are clean energy technologies such as wind/solar/carbon capture and storage, building improvements, industry process upgrades, and transport-related hybrids/electric vehicles/fuel-cell vehicles.

continued…

13 Note that BNEF numbers include asset finance for renewable power (e.g. wind, solar, etc.), biofuels, and CCS, but *exclude* asset finance for building/industry efficiency, advanced transportation, hydrogen, and fuel cells. This omission makes the BNEF data not directly comparable with the IEA estimates cited above. See Appendix B.

14 IEA, *Energy Technology Perspectives 2012: Pathways to a Clean Energy System*, 8. The IEA's scenario for 6 °C (6DS) of warming corresponds to atmospheric concentration of CO2 more than doubling by 2050 (relative to a 2009 baseline), which the IEA projects will happen should there be no strengthening of climate and clean energy policies from what was in place in mid-2013. The IEA's 6DS is generally consistent with the Current Policy Scenario in its 2013 World Energy Outlook. Note, however, that implementation of efficiency/renewable/fossil fuel reform/carbon prices measures already announced in 2013, but not yet implemented—as the IEA assumes in its New Policies Scenario—reduces future warming to for 3.6 °C, rather than 6 °C. IEA, *World Energy Outlook 2013*, 24.

DEFINING THE CLEAN TRILLION *…continued from previous page.*

The clean energy investment figures from BNEF ($281 billion in 2012, for example) are based on a slightly narrower definition of clean energy. The BNEF figure provides a comprehensive picture of power sector investments, but has more limited coverage of the building, industry and transport sectors. Partly this reflects data for certain sectors (i.e. building energy efficiency) lacking the quality and availability to allow for rigorous analysis. The BNEF figures also include sub-categories of investment, such as government and corporate R&D as well as mergers and acquisitions, which are less apt to be captured in IEA's numbers, which are more focused on costs of technology deployment. This paper looks most closely at the clean energy universe based on BNEF's classification.

The clean energy investment figures from Bloomberg New Energy Finance ($281 billion in 2012, for example) are based on a slightly narrower definition of clean energy.

For 2012, the Climate Policy Initiative estimated that $297 billion was invested in renewable energy generation and energy efficiency, with several billion more devoted to industry process improvements and sustainable transport. These figures do not include private investment for energy efficiency upgrades, industry process improvements, and sustainable transport. In other words, as with BNEF, the universe covered by CPI's numbers is relatively smaller than is the universe in the IEA forecasts.

A key takeaway from these differing figures is the broad shortcomings of existing clean energy investment data for policymakers and private markets alike. Such limitations underpin our call in Recommendation 4 for more rigorous and comprehensive data on clean energy finance.

For the full list of clean energy technologies in the IEA projections, and further discussion on this overall topic, see Appendix B.

SOURCES OF CAPITAL FOR THE CLEAN TRILLION—PARTICULARLY INVESTMENT IN CLEAN ENERGY INFRASTRUCTURE

Recognizing the different asset classes—and the leading role of investment in infrastructure projects, as opposed to investment in companies—the next key issue is who is supplying the capital. Today's leading providers of investment capital to clean energy projects are commercial banks, national and multilateral development banks (e.g. the World Bank, European Investment Bank, or other quasi-public sector entities), and electric utilities. These sources alone, however, will be vastly insufficient to double global clean energy investment by 2020 or quadruple it by 2030.[15] In the power sector, utility balance sheets are under strain, and in many, cases cannot support billions of dollars of new capital expenditures. Banks, prodded by new capital charges on illiquid assets under Basel III, are becoming less willing to provide long-term, non-recourse project finance loans.[16]

The critical role of institutional investors

Clean energy projects need new and substantial sources of investment capital, and the largest potential provider are institutional investors such as pension funds, insurance companies, endowments, foundations and investment managers. Globally, these investors control approximately $75.9 trillion in assets under management (AUM),[17] of which analysts estimate roughly $45 trillion to be long-term assets devoted to meeting long-term institutional obligations.[18]

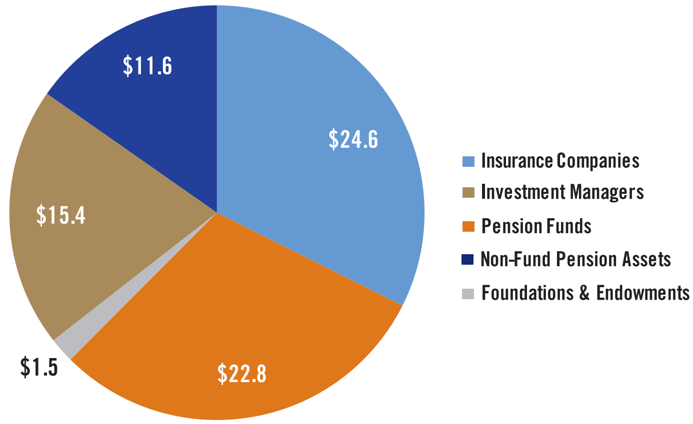
15 Kaminker C. and F. Stewart, "The Role of Institutional Investors in Financing Clean Energy," *OECD Working Papers on Finance, Insurance and Private Pensions*, No. 23, OECD Publishing, 2012, http://www.oecd.org/environment/WP_23_TheRoleOfInstitutionalInvestorsInFinancingCleanEnergy.pdf

16 For example, early implementation of Basel III by the European Union has seen European banks unload over $11 billion in project finance loans (often at discount prices) to U.S. and Japanese banks. Travis Lowder's blog, "Who's Afraid of Basel III," US National Renewable Energy Laboratory, August 13, 2012, https://financere.nrel.gov/finance/content/whos-afraid-basel-iii. For more discussion of this point see Appendix D.

17 Climate Policy Initiative (CPI), *The Challenge of Institutional Investment in Renewable Energy*, March 2013, 7 (Table 2.1), http://climatepolicyinitiative.org/wp-content/uploads/2013/03/The-Challenge-of-Institutional-Investment-in-Renewable-Energy.pdf The estimate of $75.9 trillion (1) excludes $3.9 trillion of assets held by sovereign wealth funds; and (2) adjusts for double-counting by reducing assets of investment managers by $15 trillion (i.e. to account for pension insurance contracts and pension assets potentially invested in mutual funds, ETFs, hedge funds and private equity funds).

18 A "long-term" investor in this sense being one that has predictable cash needs and objectives that extend beyond 5-10 years. CPI, T*he Challenge of Institutional Investment in Renewable Energy,* 7 (Table 2.1).

FIGURE 4: TOTAL ASSETS BY TYPE OF INSTITUTIONAL INVESTOR (IN TRILLIONS OF 2010 USD)
GLOBAL TOTAL OF $75.9 TRILLION



Note: Excludes $3.9 trillion of assets held by sovereign wealth funds. Figures above have adjusted for double-counting by reducing assets of investment managers by $15 trillion (i.e. to account for pension insurance contracts and pension assets potentially invested in mutual funds, ETFs, hedge funds and private equity funds). Of this total, analysts estimate roughly $45 trillion to be assets devoted to long-term investment.

Source: Climate Policy Initiative (2013), based on data from OECD. Stat Insurance Statistics, OECD. Stat Pension Statistics, TheCityUK (2011a and 2012a), Investment Company Institute, Sovereign Wealth Fund Institute, McKinsey Global Institute (2011).

Out of their $75.9 trillion AUM, however, institutional investors in OECD countries currently hold very little investments directly or indirectly in projects. The most recent annual OECD Large Pension Fund Survey found that less than 1 percent of institutional investor assets were allocated to infrastructure projects—and an even smaller share (~0.1 percent) was allocated to clean energy infrastructure projects[19] (investors can, in fact, make investments either directly or through other vehicles in infrastructure projects). Analysts calculated that from 2004-2011, only $22 billion of asset finance for clean energy came from pension funds and insurance companies—or less than 2.5 percent of total clean energy asset finance globally over this period.[20]

The annual OECD Large Pension Fund Survey … concluded that less than of 1 percent of their assets were allocated directly to infrastructure projects—and an even smaller share (~0.1 percent) in clean energy infrastructure projects.

Increasing institutional allocations to clean energy infrastructure projects is essential to meeting the Clean Trillion goal of doubling annual global clean energy investment by 2020. Fortunately, significant opportunities are available to make this happen. Taking into account liability constraints, risk limits (e.g. funding ratios, capital requirements, etc.), and diversification requirements, the Climate Policy Initiative estimates up to $819 billion of institutional capital is available for investment in renewable energy projects specifically (via both direct investments and indirect pooled investment vehicles).[21] More broadly, the World Economic Forum estimates up to $6.5 trillion of potential institutional investment in long-term infrastructure in general (including renewable energy and other clean energy projects).[22] The longer the time frame considered, the greater the potential for investors to reallocate assets toward clean energy. In the near term, the OECD notes cash flows into pension funds as a result of new contributions (estimated at $960 billion annually) and premium income from annuity and life insurance contracts (estimated at $1,843 billion annually) as more readily available sources of funds for new clean energy investment.[23]

19 Kaminker C. and F. Stewart, "The Role of Institutional Investors in Financing Clean Energy," 16.

20 Kaminker C. and F. Stewart, "The Role of Institutional Investors in Financing Clean Energy," 20-22. 2.5 percent number is author's calculation based on comparing OECD numbers (which are drawn from BNEF data) with BNEF data on total asset finance 2004-2011.

21 Note that this estimate excludes investment managers. CPI, *The Challenge of Institutional Investment in Renewable Energy*, 18. CPI estimates $257 billion available from institutional investors for direct project investments, which it then breaks down into $66 billion for project equity and $191 billion for project debt. CPI then estimates up to another $562 billion of potential investment via pooled investment vehicles ($272 billion project equity and $290 billion project debt).

22 World Economic Forum (in collaboration with Oliver Wyman), *The Future of Long-Term Investing*, 2011, 16-19, http://www3.weforum.org/docs/WEF_FutureLongTermInvesting_Report_2011.pdf. See also TUAC and ITUC CSI IGB, *What role for pension funds in financing climate change policies?*, May 23, 2012, http://www.ituc-csi.org/what-role-for-pension-funds-in,12358?lang=en.

23 Kaminker, C. and F. Stewart, "The Role of Institutional Investors in Financing Clean Energy", 14-15.

FINANCING VEHICLES FOR INSTITUTIONAL INVESTMENT IN CLEAN ENERGY INFRASTRUCTURE

There are a variety of vehicles for institutional investors to increase allocations to clean energy infrastructure.[24] In the discussion below we use the taxonomy set out by the OECD. Though in terms of dollar volume, the largest opportunities by far involve the corporate securities of *companies*, there is also a critical role for direct and so called semi-direct investments via other investment vehicles in the debt and equity of clean energy *projects*. Such investments are important because they: (1) lead directly to clean energy deployment; (2) maximize alignment between the cash flow profile of clean energy projects (stable, often inflation-adjusted, over periods of 25-30 years) and the long-term liabilities and funding requirements of pension funds and insurers; and (3) have the potential to reduce the cost of capital for clean energy projects, thereby promoting large-scale deployment. While the recommendations in this paper seek to promote institutional investment in clean energy across all asset classes, there is a particular focus on ramping up allocations to clean energy infrastructure (via direct and semi-direct investments where possible, and via indirect corporate securities where necessary). (See Figure 5, next page)

Direct investment—debt and equity of projects

For some investors there are constraints on direct project investments, in which semi-direct and indirect channels will make more sense. Among other issues, such constraints may include (1) regulatory restrictions on infrastructure investment (e.g. particularly for pension funds in developing countries);[25] (2) insufficient size to make direct investments; and (3) liquidity or risk constraints.[26]

In the case of equity (typically 20-40 percent of total capital for a clean energy project), the main category of direct investment is through ownership of projects:

- ***Investment in projects:*** This represents direct ownership of a project. Examples of this include global insurer Met Life's direct investment in a solar PV power plant in Texas, and Dutch pension fund PGGM's significant ownership stake in a 367-megawatt offshore wind project in the Irish Sea off England.[27]

In the case of debt (typically 60-80 percent of total capital for a clean energy project), categories of direct debt investment include:

- ***Clean energy project bonds:*** These are bonds whose payments are linked to the cash flows from a clean energy project.[28] Through November 2013, clean energy projects (chiefly involving wind and solar) had issued over $7 billion of project bonds globally.[29] Pension funds and insurance companies—particularly North American insurance companies such as Met Life, AIG, and Allstate—have bought the majority of these issuances.[30] The market for these bonds is poised to grow substantially. On the demand side, Zurich Insurance announced in Nov. 2013 that it would acquire $1 billion of green bonds issued by the World Bank and other development institutions, seeing this as "an opportunity to invest both with impact and at a return fully compensating for the risk."[31] On the supply side, given a pipeline of 225 utility-scale (typically 95 megawatts and above) wind and solar projects in the U.S. and Europe, Bloomberg New Energy Finance estimates a potential clean energy project bond market of $142 billion, with bond issuances of $18-$40 billion annually, by 2020 (up from roughly $2 billion a year today).[32] Most of these issuances would involve refinancing of project debt.

BNEF estimates a potential clean energy project bond market of $142 billion, with bond issuances of $18-$40 billion annually by 2020 (up from roughly $2 billion a year today).

24 For discussion of the expected and historic returns from different asset classes related to clean energy, see Appendix C.

25 For more discussion of this point, see Appendix D.

26 CPI, *The Challenge of Institutional Investment in Renewable Energy*, 65-68.

27 Kaminker, C. et al., "Institutional Investors and Green Infrastructure Investments: Selected Case Studies," *OECD Working Papers on Finance, Insurance and Private Pensions,* No. 35, OECD Publishing, 2013, http://www.oecd-ilibrary.org/finance-and-investment/institutional-investors-and-green-infrastructure-investments_5k3xr8k6jb0n-en.

28 This is distinct from the case of a typical corporate bond, where a corporate issuer assumes a general obligation to pay the bond's interest and principal.

29 BNEF, "Green Bonds Market Outlook 2013: Ripe pickings at the green bond market," 2013. Note that the $7 billion figure includes only a portion of private placement debt and that the actual figure for outstanding clean energy project bonds could be significantly higher.

30 Kaminker, C. et al., "Institutional investors and Green Infrastructure Investments: Selected case Studies," 42.

31 Zurich Insurance press release, "Zurich invests up to USD 1 billion to help communities adapt to climate change," November 18, 2013, http://www.zurich.com/media/newsreleases/2013/2013-1118-01.htm

32 Bloomberg New Energy Finance, *Green Bonds Market Outlook 2013*, 2013. Note that including potential bond issuances from portfolios of rooftop solar PV or onshore wind projects increases the potential market size even further.

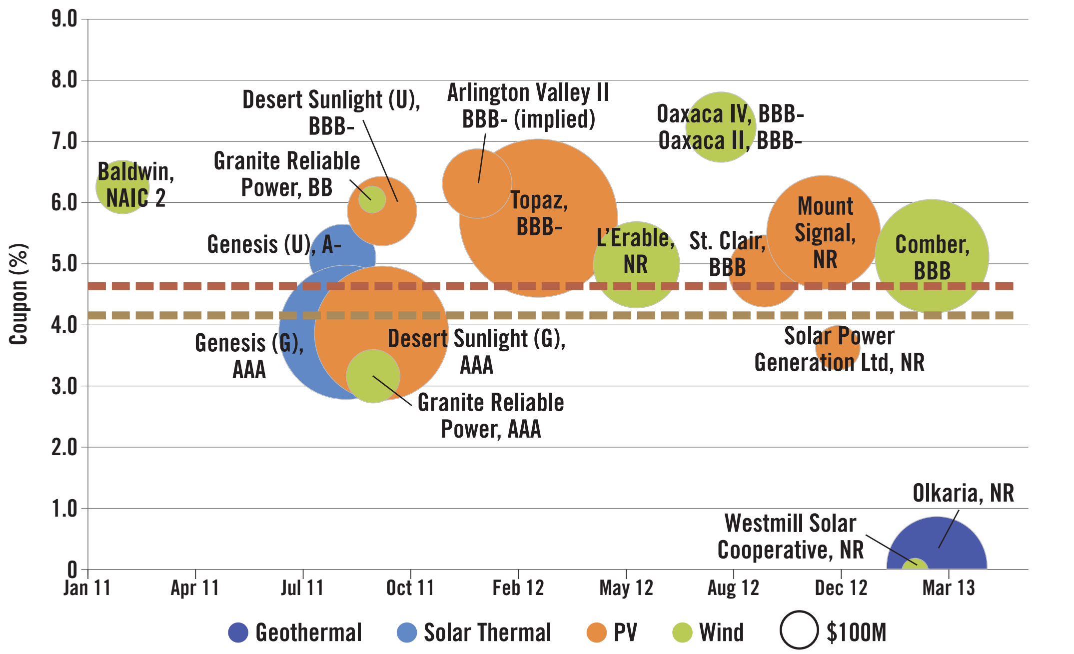
FIGURE 5: VEHICLES FOR INSTITUTIONAL INVESTMENT IN CLEAN ENERGY INFRASTRUCTURE

Low/No Connection to Project or Potential to Lower Capital Costs → High Connection to Project or Potential to Lower Capital Costs

	Corporate Investment (Indirect)	Investment Fund/Vehicle (Semi-Direct)	Project Investment (Direct)
Description	• Publicly listed equity/corporate bonds, funds, private placement corporatebonds/mezzanine finance.	• Investment in pooled vehicles such as infrastructure venture capital/private equity funds that invest in companies (indirect) or projects (direct); asset backed securities; covered bonds; aggregator bonds; MLPs, REITs	• Direct investment (principal) in unlisted green infrastructure project through equity, debt (loan or private/public project bond with asset linkage)or mezzanine; Public Private Partnerships and export order facilities
Benefits	• Highly liquid markets, low transaction costs • Well understood investment by institutional investors, available investment research, established benchmarks, historical data • Higher risk/higher return • Easy access for even small estlis; investment managers as conduit	• Wide range of fund design and customization • Liquid vehicles possible if listed with secondary markets for bonds, illiquidty premium if gated fund • Well understood investment by institutional investors; • Access for smaller lis, aggregation benefits; private equity or asset manager as conduit	• Reasonably steady, lower risk, predictable returns with potentia lilliquidity premium of 1-3% for project fin debt (potentially more for equity) • Direct link to (and control of) asset-potential to lower cost of capital • Asset/Liability Matching (ALM); inflation hedge; lowest market ß if held to maturity (protection from market volatility) • Large deal size; some 'tag along' value for smaller institutional investors; hybrid equity structure can give bond-like payments
Issues to Scaling Up	• Few 'pureplay' green infrastructure companies • Low/no connection to project and associated benefits; scaling up won't lower cost of capital for green infrastructure • Additional corporate and market securities risk (lower for debt) • Sector diversification limits • Smaller companies face ratings and index restrictions to issuance (particularly for debt) • Increased issuances tied to balance sheet fund raising capacity	• High fees needed to support fund structure high transaction costs for bonds • Difficult to structure liquidity in funds; low connection to project & associated benefits if liquidity offered; no secondary markets • Traded funds take on market risk; portfolio & sector diversification limits; bonds need to secure adequate ratings; lack historical data • Competition for capital within asset class; returns not as high/stable as traditional infra. • Autonomous private equity funds can create churn (buy/sell) and leverage risk-asset disconnect	• Short term investor horizons; illiquidity biases • Institutional investors need size >$50Bn Assets under Management and deal flow to maintain costly team (with a few exceptions) • Min $100M deal size; expensive and time consuming due diligence; higher transaction costs; competition for capital w/ other traditional infrastructure assets • Lack of project pipeline; diversification restrictions & financial regulation illiquidity restrictions; tax incentive complications • Traditional ALM may not recognize benefits; bench marking difficulties; mark to market acct
Examples	• 02/11 Bright Source (US Solar Thermal) sold Series E preferred shares to **CalSTRS** after raising $150M Series D venture capital financing partly from CalSTRS and Alstom • 04/12 Esval (Chilean water utility) sold $46M of inflation-linked corporate bonds to **Ontario Teachers' Pension Plan**.	• 01/10 **BT Pension Scheme** invested £75M in Hermes Private Equity • 10/07 Dutch pension funds **ABP** and **PGGM** invested €500m in Ampere (private equity fund investing in wind parks and biomass projects) • CRC Breeze Bonds (case study 4)	• 08/13 **Pension Danmark** invested $200M in mezzanine finance to Cape Wind Nantucket Offshore Wind • 02/11 **PGGM** invested equity in Walney Offshore Wind (case study #2)
Target Return Range	**Target equity returns: 5-20% debt: 3-6%; actual returns N/A**	**Infrastructure fund target returns 7-20%+; actual returns: -51% to 106%**	**Project equity target returns 12-18% debt 6-10%; actual returns: -13 -21%**

Source: OECD authors' analysis based on OECD (2012a) CPI (2013), DBCCA, 2011, 2012.

FIGURE 6: COUPONS & OFFERING SIZE FOR CLEAN ENERGY PROJECT BOND ISSUANCES, 2011-PRESENT



Source: Bloomberg New Energy Finance, 2013.
Source: OECD authors' analysis based on OECD (2012a) CPI (2013), DBCCA, 2011, 2012.

Semi-direct investment (in pooled investment vehicles and project-related capital markets products)

For investors unwilling or unable to invest directly in clean energy projects, there are multiple other vehicles for so called "semi-direct" investment in clean energy infrastructure. Many investors see this as the most likely way to major scale up.

- ***Private equity funds and publicly-listed infrastructure funds:*** These offer another way of investing in clean energy infrastructure, albeit (in the case of private equity) with accompanying fees that do not exist for direct investments. From 2007-2011, "green" private equity funds raised an average of $23 billion in new capital annually.[33] For smaller institutional investors without the resources to undertake project-level investments, private or publicly listed funds will often be the most direct route to supplying equity to clean energy infrastructure.
- ***Asset-backed "securitized" bonds:*** Though any bond linked to the cash flows from any clean energy project may be called an "asset-backed security," in this case we are referring to securities whose payments are backed by a specified pool of revenue-generating assets. Most clean energy projects are too small to issue individual bonds; as a result, the best way to link such projects to capital markets is to pool, or "securitize," them into a "special purpose vehicle," and then issue bonds backed by the cash flows from this pool. For example, securitization is seen as a promising way to provide debt finance for portfolios of rooftop solar PV projects, a recent example being SolarCity's recent approval from Standard & Poor's to sell $54 million of notes backed by residential solar leases.[34]

Securitization is seen as a promising way to provide debt finance for portfolios of rooftop solar PV projects, a recent example being SolarCity's approval to sell $54 million of notes backed by residential solar leases.

33 DB Climate Change Advisors, Cleaner Technologies: Evolving Towards a Sustainable End-State, 2012, https://www.db.com/cr/en/docs/Cleaner_Technologies-Evolving_Towards_a_Sustainable_End-State_201207.pdf.

34 CleantechIQ, "SolarCity Launches S&P Rated Bonds, Plans to Raise $54M," November 15, 2013, http://cleantechiq.com/2013/11/solarcity-launches-sp-rated-bonds-plans-to-raise-54m.

- ***Climate Bonds:*** Though the definition of "climate bonds" usually includes the project bonds discussed above, it also includes plain vanilla "treasury-style" bonds used to raise capital that are then distributed across a variety of "climate-themed" projects.[35] As repayment is linked to the issuer's overall creditworthiness (as opposed to the cash flows of a specific projects), such issuances often earn AAA credit ratings (though the exact rating depends on the creditworthiness of the issuer). Leading issuers of climate bonds include development banks such as the World Bank and International Finance Corporation. Though still a fraction of the $78 trillion global bond market, the Climate Bonds Initiative tallied $74 billion of new climate-themed bonds in 2012 alone, up 25 percent from 2011. Much of this money, however, went to projects outside this paper's definition of "clean energy," such as development of rail transit in China.[36] Still, climate bonds offer a compelling near-term opportunity for pension funds and insurers to invest more in clean energy infrastructure.
- ***Covered Bonds:*** Between AAA-rated climate bonds issued by multilateral development banks and asset-backed securities reliant on cash flows from clean energy projects, there is a potential middle ground—"covered bonds" issued by banks. Covered bonds use a "dual recourse structure" where bond investors have a claim over: (1) a "cover pool" of assets, the quality of which is strictly regulated; and (2) a general unsecured claim against the issuer.[37] This dual recourse structure enables covered bonds to enjoy superior credit ratings and lower funding costs compared with unsecured debt issued by banks, while also presenting lower risk for investors relative to pure asset-backed securities.[38] The $2.5 trillion covered bond market currently supports lending to designated areas, such as housing and public infrastructure, in nearly 40 countries. This paper explores proposals to extend covered bonds to clean energy infrastructure.
- ***YieldCos:*** Shifting from debt to equity, a "YieldCo" is a liquid, publicly traded entity that owns cash-generating infrastructure assets. Currently this structure exists mainly in the U.S. market, but resembles publicly listed infrastructure funds abroad. YieldCos typically require an asset base of at least $500 million and an IPO value of $150-200 million. For example, in July 2013 NRG Energy successfully spun off a major portfolio that consists of 15 natural gas, solar and wind facilities, each with long-term power purchase agreements, through a $430 million IPO called NRG Yield. As the name suggests, YieldCos appeal to investors for whom dividends and cash yields are chief investment objectives.[39]

Indirect investment (in corporate equity and debt)

Finally, the least direct (but most accessible) way to invest in clean energy infrastructure is through investment in stocks or bonds of either pure-play clean energy companies or other companies that build clean energy projects. As of September 2013, the 96 companies on the WilderHill New Energy Global Innovation Index had a combined market capitalization of $273 billion.[40]

Moreover, as this reflects only pure-play clean energy companies, there is a much broader universe of companies—electric utilities/independent power producers, diversified industrial companies—that also play a role in developing clean energy infrastructure. Particularly with respect to corporate bonds, opportunities for clean energy-related investment involve the bonds of utility/diversified industrial companies as opposed to pure-play clean energy names.

35 Clean energy being just one category of such projects, with other categories including agriculture, forestry, and water.

36 *Climate Bonds Initiative and HSBC, Bonds and Climate Change: The State of the Market 2013*, June 2013, http://www.climatebonds.net/files/Bonds_Climate_Change_2013_A3.pdf. Note that this $74 billion figure includes many sector categories (e.g. Rail Transport, Agriculture and Forestry, Waste and Pollution Control) not included in the BNEF definition of "clean energy" used in this paper.

37 Note how this is different from pure asset-backed securities, where repayment depends on the performance of a defined pool of assets owned by a special purpose vehicle.

38 Damerow, F., Kidney, S., and S. Clenaghan, "How Covered Bond markets can be adapted for Renewable Energy Finance and how this could Catalyse Innovation in Low-Carbon Capital Markets: Unlocking bank lending in an era of capital constraint and limited public budgets, Climate Bonds Initiative Discussion Paper, May 2012, http://www.climatebonds.net/wp-content/uploads/2012/05/Climate-Bonds_RE-covered-bonds_22May20121.pdf

39 Alex Anich, "The Emerging YieldCo Landscape," RenewableEnergyWorld.com, October 24, 2013, http://www.renewableenergyworld.com/rea/blog/post/2013/10/the-emerging-yieldco-landscape

40 WilderHill New Energy Global Innovation Index Fact Sheet, September 30 2013, http://www.nexindex.com/pdf/2013_09_30_NEX percent20Factsheet.pdf

BARRIERS TO AND BENEFITS FROM CLEAN ENERGY INVESTMENT

Investors with fiduciary responsibilities will not make an investment just because it is green—their primary concern is its (risk-adjusted) financial performance.

— OECD, "Institutional investors and green infrastructure investments: Selected case studies"

Selected investments in climate-sensitive assets, with an emphasis on those that can adapt to a low-carbon environment, could actually reduce portfolio risk in some scenarios. This offers the prospect that institutional investors' interests can be aligned to both serve their beneficiaries' financial interests as well as help tackle the wider challenge of climate change by increasing investment in mitigation and adaptation efforts globally.

— Mercer, "Climate change scenarios: Implications for Strategic Asset Allocation"

Barriers to Clean Energy Investment

Simply articulating the magnitude of our current clean energy investment gap will do little to mobilize additional capital. Achieving the Clean Trillion will require opportunities for clean energy investment with risk-adjusted returns that suit the varying risk preferences, investment styles and credit/liquidity constraints of different classes of investors. A recent OECD report has rightly emphasized competitive risk-adjusted returns over different time horizons as an "indispensable and essential condition" for institutional investment in clean energy infrastructure.[41] This condition, however, applies just as strongly to other classes of clean energy investment (e.g. in the publicly-traded stock or bonds of clean energy companies).

Focusing on clean energy infrastructure, Figure 7 (next page) summarizes current barriers to investment.

Benefits to Investors: Enhancing Long-Term Performance, Minimizing Exposure to Systemic Climate Risk

Recognizing the obstacles above, increasing investment in clean energy has the potential to yield two major benefits for investor portfolios.[42]

The first benefit is the potential to improve portfolio performance. This applies especially to investment in clean energy infrastructure vehicles, whether via debt or equity. Such projects offer cash flows that have low volatility, low correlation to other assets, and (often) are indexed to inflation. Such stable cash flows are an excellent match for long-term funding needs and liabilities of pension funds and insurance companies (and are particularly attractive given current low yields on government bonds). Many pension funds are currently seeking to increase their infrastructure allocations for these reasons. For more discussion of this point, see the "Risk and Return" text box (page 25) and Appendix C.

The second benefit is to minimize exposure to potential carbon asset risks. According to the IEA, more than two-thirds of the world's proven reserves of fossil fuels cannot be consumed prior to 2050 under the 2°C pathway.[43] The next wave of fossil fuel investment, potentially as much as $7 trillion in the coming decade,[44] may lead to stranded fossil fuel assets that erode long-term shareholder value.[45] Current and future action to mitigate climate change will strongly affect the valuations of fossil fuel companies—perhaps by as much as 60-80 percent[46]—and is already happening with U.S. coal companies whose values have

41 Kaminker, C. et al., "Institutional Investors and Green Infrastructure Investments: Selected Case Studies," 9.

42 For more detail on the risk-return impacts of each Recommendation, see the text box below and Appendix C.

43 IEA, *World Energy Outlook 2012*, (Paris: OECD/IEA, 2012), 34-35.

44 Assuming that over the coming decade annual upstream capital investment in fossil fuels is at least equal to the IEA's 2012 estimate for upstream oil and gas capital investment of nearly $700 billion. IEA, *World Energy Outlook 2013*, (Paris: OECD/IEA, 2013).

45 CarbonTracker and the Grantham Research Institute, *Unburnable Carbon 2013: Wasted capital and stranded assets*, 2013, http://www.carbontracker.org/wastedcapital. Generation Foundation, *Stranded Carbon Assets: Why and How Carbon Risks Should Be Incorporated in Investment Analysis*, October 30 2013, http://genfound.org/library/.

46 HSBC Global Research, *Oil & Carbon Revisited —Value at Risk from 'Unburnable' Reserves'*, January 25 2013.

FIGURE 7: SUMMARY OF BARRIERS TO INSTITUTIONAL INVESTMENT IN CLEAN ENERGY INFRASTRUCTURE

1 Issues with infrastructure investments	• **Direct investing challenges** - Short term investment horizon and need for liquidity (illiquidity risk) - Difficulties with bidding process and timing; lack of investor best practice and expertise - Asset and liability matching (ALM) application issues; diversification and exposure limits - Need scale >$50Bn AuM and dealflow to maintain costly team - Min $100M deal size; expensive and time consuming due diligence; higher transaction costs; • **Regulatory and policy issues** - Political uncertainty - Illiquidity and direct investment restrictions e.g. capital adequacy rules (Solvency II, IORP II) - Uncertain new policy application e.g. Solvency II for pension funds? - Accounting rules e.g. mark to market for illiquid assets • **Lack of project pipeline and quality historical data** - Compounded by exit of banks (Basel III/deleveraging) - Little historical pricing data or indices for investments such as private placement debt
2 Issues particular to green investments	• **Risk/return imbalance** - Market failures: insufficient carbon pricing and incentives; presence of fossil fuel subsidies • **Unpredictable, fragmented, complex and short duration policy support** - Retroactive support cuts, switching incentives (FiT to FiP) or start and stop (PTC) - Use of tax credits popular with insurers can discourage tax exempt pension funds - Unrelated policy objective discouragement e.g. EU unbundling preventing majority ownership of both transmission and generation/production - Fiduciary duty debate • **Special species of risk, e.g. technology and volumetric require expertise and resources** • **Competition for capital with other traditional infrastructure assets**
3 Lack of suitable investment vehicles	• **Issues with fund and vehicle design** - High fees to support fund structure - Liquidity trade-off with connection to underlying asset and associated benefits: difficult to offer liquidity without asset disconnect, churn and leverage in fund • **Nascent green bond markets, no indices/funds, restricted access to liquid vehicles (MLPs & REITs)** - Small pipeline of projects, high transaction costs, minimum deal size and definition uncertainty • **Challenges with securitization** • **Credit and ratings issues** - Historical lack of ratings data, expensive process - Absence of monoline insurers since financial crisis

Source: OECD 2013

dropped dramatically since 2011. Even companies not directly engaged in fossil fuel production or fossil fuel generation will be negatively affected. For example, in a 2011 Mercer estimated that over the next twenty years climate policy could account for as much as 10 percent of overall risk in investor portfolios.[47]

Conversely, clean energy investments that benefit from action to reduce carbon emissions and can serve as a "climate hedge" to balance carbon asset risks in investment portfolios. For a typical portfolio targeting a 7 percent annual return, Mercer's 2011 analysis indicated the potential, under certain scenarios, to manage climate risks by allocating roughly 40 percent of assets to "climate-sensitive" assets such as energy efficiency and renewable energy-related listed equities, private equity, and infrastructure.[48] Though in a vacuum such investments might be deemed excessively risky, Mercer emphasizes that certain climate-sensitive investments, particularly those that promote a low-carbon future, may in some scenarios reduce overall portfolio risk—creating "the prospect that institutional investors' interests can be aligned to both serve their beneficiaries' financial interests as well as help tackle the wider challenge of climate change by increasing investment in mitigation and adaptation efforts globally."[49]

Investors are responsible for managing long-term risks and investing in clean energy will help to achieve this objective.

47 Mercer, *Climate Change Scenarios—Implications for Strategic Asset Allocation*, February 15 2011, 9, http://www.mercer.com/articles/1406410

48 Mercer, *Climate Change Scenarios—Implications for Strategic Asset Allocation*, 2. Note that the full range of "climate-sensitive assets" also included assets not related to clean energy, such as agricultural and timber holdings.

49 Ibid, 9.

10 Key Recommendations for Achieving the Clean Trillion

This paper outlines 10 recommendations to ramp up clean energy investment while also meeting investor risk and return requirements. Most of the recommendations call for direct investor activities, but several also call for encouraging companies, regulators and policymakers to pursue necessary policies and actions to expand clean energy investment. Though some institutional investors may view engagement with regulators and policymakers as beyond their purview, analyses of climate risk has concluded that such engagement "can play a vital role in overall portfolio risk management."[50]

➡ Mobilize Investor Action to Scale Up Clean Energy Investment

1. **Develop capacity to boost clean energy investments and consider setting a goal such as 5 percent portfolio-wide clean energy investments**
2. **Elevate scrutiny of fossil fuel companies' potential carbon asset risk exposure**
3. **Engage portfolio companies on the business case for energy efficiency and renewable energy sourcing, as well as on financing vehicles to support such efforts**
4. **Support efforts to standardize and quantify clean energy investment data and products to improve market transparency**

Recommendation (1) asks assets owners to develop the capacity to identify and pursue investment opportunities in the clean energy space and consider setting clean energy investment goals across all asset classes within a reasonable time period (such as five years or by 2020). If all global institutional investors were to allocate 5 percent of their portfolios to clean energy, it would amount to $2.25 trillion of additional investment[51] (i.e. an amount equal to 45 percent of required "Clean Trillion" investment through 2020, or 17 percent of required "Clean Trillion" investment through 2030).[52] **Recommendation (2)** asks investors to elevate their scrutiny of fossil fuel companies' carbon asset risk exposure and engage with companies to ensure they are preparing for a low-carbon future and that shareholder capital is not being invested unwisely on high cost, high carbon fossil fuel reserves. **Recommendation (3)** examines how through investor engagement with companies, businesses can reduce both operating costs and carbon emissions through greater energy efficiency and renewable energy use. **Recommendation (4)** emphasizes the need to accurately measure actual investment flows to clean energy, including standardizing definitions of what constitutes a "climate-themed" investment.

If all global institutional investors were to allocate 5 percent of their portfolios to clean energy, it would amount to $2.25 trillion of additional investment.

➡ Promote Green Banking and Debt Capital Markets

5. **Encourage "green banking" to maximize private capital flows into clean energy**
6. **Support issuances of asset-backed securities to expand debt financing for clean energy projects**
7. **Support development bank finance and technical assistance for emerging economies**

Recommendations (5) and **(6)** focus on developing the critical bond market products that will likely supply 60-80 percent of total financing for clean energy infrastructure. The most successful outcome would be investment-grade bond issues (whether from individual large projects or aggregations of

50 Ibid, 9.

51 Using CPI's 2013 estimate of $45 trillion in long-term institutional capital. CPI, *The Challenge of Institutional Investment in Renewable Energy*, 7 (Table 2.1).

52 The 45 percent and 17 percent amounts are calculated based on the total additional investment in clean energy in a 2 degree pathway relative to a 6 degree pathway from 2010-2020 (roughly $5 trillion) and 2010-2030 (roughly $13 trillion). For more explanation, see Appendix B.

The most successful outcome would be investment-grade bond issues (whether from individual large projects or aggregations of smaller projects) that are sold directly into institutional bond portfolios.

smaller projects) that are sold directly into institutional bond portfolios. Given the dearth of bond issues from clean energy projects, this paper emphasizes providing access to debt markets via asset-backed securities, covered bonds and other instruments capable of providing scalable, liquid investment opportunities. Moreover, since project-based debt will take time to scale up, it is critical in the short term to redouble efforts to harness the $78 trillion global bond market[53] to support clean energy through increased issuance of "green" or "climate" bonds by development banks and corporate issuers. The strong income component of clean energy project bonds and asset-backed securities may particularly appeal to certain liability-driven investors. **Recommendation (7)** focuses on a related area—development banks—and how to increase North-South flows of clean energy investment from a 2012 level of $10.2 billion[54] to a 2020 level of $100 billion (thereby helping to fulfill commitments made by developed countries under the UN-led Cancun Agreements).[55]

➡ Reform Climate, Energy and Financial Policies and Regulation

8. **Support regulatory reforms to electric utility business models to accelerate deployment of clean energy sources and technologies**
9. **Support government policies that result in a strong price on carbon pollution from fossil fuels and phase out fossil fuel subsidies**
10. **Support policies to de-risk deployment of clean energy sources and technologies**

With the balance sheets of electric utilities accounting for 30 percent of global clean energy investment in 2012,[56] and the power sector accounting for 27 percent of required clean energy investment in a 2°C pathway through 2020, **recommendation (8)** details changes to business practices and regulatory reforms that investors can support to better prepare the electric power sector for massive new investments in energy efficiency and renewable energy (particularly from distributed generation resources). **Recommendations (9)** and **(10)** focus on supporting deployment of clean energy technologies (a prerequisite to creating opportunities for investment). The first step in doing this is to encourage governments to impose carbon-reducing policies that result in meaningful prices on carbon pollution from fossil fuels. Increasing the share of global CO_2 emissions subject to some form of carbon price to 50 percent (from the current share of 7 percent)[57]—as will occur if developed countries broaden existing programs and major emerging economies enact already planned initiatives—will create enormous opportunities for clean energy investment. Importantly, in anticipation of broader adoption of carbon-reducing regulations, many companies are already using 'shadow' carbon prices in business and capital planning. Investors should support such activity.

Further, given how large-scale deployment lowers the costs of clean energy technologies, leading to further deployment, policymakers should complement carbon prices with other measures to bolster demand for clean energy. This is the area of incentives that markets often focus on first, but needs to better understood in the context of falling clean energy prices and an eventual level playing field.

Additionally, with banks currently providing $50 billion per year of loans to clean energy projects, Appendix D explores the implications of new bank liquidity requirements and also discusses other financial regulations relevant to the recommendations in this paper.

53 Climate Bonds Initiative blog, "9 useful facts about the global bond market," Feb 27, 2013, http://www.climatebonds.net/2013/02/9-useful-facts-bond-markets/.

54 BNEF, *Global Trends in Clean Energy Investment*, 31. In 2012 this $10.2 billion amounted to 26 percent of total cross-border renewable energy asset finance.

55 US State Department, "Strategies and approaches for scaling up long-term finance," October 7, 2013, http://unfccc.int/files/documentation/submissions_from_parties/application/pdf/cop_suf_usa_07102013.pdf.

56 Angus McCrone, "Clean Energy: Green Shoots of Institutional Investment," *BNEF White Paper*, October 4, 2013, http://about.bnef.com/blog/clean-energy-green-shoots-of-institutional-investment/.

57 For a survey of existing and planned systems, see Carbon Finance at the World Bank, "Mapping Carbon Pricing Initiatives: Developments and Prospects 2013", May 2013, http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/05/23/000350881_20130523172114/Rendered/PDF/779550WP0Mappi0til050290130morning0.pdf

HOW THE "CLEAN TRILLION" RECOMMENDATIONS WILL AFFECT THE RISKS & RETURNS OF INVESTMENTS IN CLEAN ENERGY

1. Develop capacity to boost clean energy investments and consider setting a goal such as 5 percent portfolio-wide clean energy investments

The heightened commitment resulting from a portfolio-wide goal would give investors the best chance of capitalizing on new clean energy-related opportunities across all asset classes, especially fixed income, as opposed to relegating this clean energy theme to just public equity or venture capital. Bolstering internal and external capacity for increased infrastructure investment, both directly and through other vehicles, will strengthen the potential to pair the necessary cash flows of clean energy infrastructure assets with investor liabilities and funding requirements.

2. Elevate scrutiny of fossil fuel companies' potential carbon asset risk exposure

In a 2011 report, Mercer warned that climate-related government policies could increase portfolio risks by 10 percent over the next 20 years. The potential for reduced demand for fossil fuels driven by non-policy factors such as increased renewable energy, energy efficiency and fuel switching, also creates risks for investors who own fossil fuel companies. Investors should be paying increased attention to carbon asset risks by engaging with fossil fuel firms, including oil and coal companies, on the potential of higher cost, carbon-intensive fossil fuel reserves becoming "stranded," thus creating long-term portfolio risks.

The potential for reduced demand for fossil fuels driven by factors other than climate policy action could significantly affect fossil fuel pricing and company valuations.

3. Engage portfolio companies on the business case for energy efficiency and renewable energy sourcing, as well as on the financing vehicles to support such efforts

Encouraging companies to aggressively pursue energy efficiency opportunities can help unlock projects with high returns, thereby creating shareholder value. By using more clean energy resources to reduce fossil fuel dependency and carbon emissions, companies will: 1) reduce vulnerability to volatile fossil fuel prices; 2) reduce exposure to future carbon regulations; and 3) identify new potential low-carbon business opportunities and customer solutions, leading to new revenues. All of these benefits underpin academic research showing that, over the long term, companies with leading environmental performance also deliver superior financial returns for investors.[58]

4. Support efforts to standardize and quantify clean energy investment data and products to improve market transparency

Standardizing definitions of key investment terms, such as what constitutes a "climate bond," will minimize the due diligence burden on investors and reduce transaction costs of investing in newer clean energy-related investment products. By reassuring potential buyers about what they are purchasing, standardization will also increase the liquidity of climate bonds and other products. Ultimately, better data on clean energy investment will foster easier, more precise benchmarking evaluation of potential deals.

5. Encourage "green banking" to maximize private capital flows into clean energy

Expanded issuance of climate bonds by multilateral banks will broaden the universe of highly-rated fixed-income products attached to clean energy, thereby making it easier for investors to increase allocations to clean energy within existing liquidity/creditworthiness constraints. Investment grade credit ratings for project bonds, such as S&P's recent approval of SolarCity bonds, will enable investors to capture the relatively higher yield of these instruments, especially relative to sovereign debt. The $2.5 trillion covered bond market offers attractive products for pension funds and insurers—extra yield relative to sovereign debt, but with less risk than unsecured bank debt or asset-backed securities—and expanding this market into clean energy will increase such opportunities.

continued…

58 DB Climate Change Advisors, *Sustainable Investing: Establishing Long-Term Value and Performance*, May 2012, https://www.dbadvisors.com/content/_media/Sustainable_Investing_2012.pdf

 …continued from previous page.

6. Support issuances of asset-backed securities to expand debt financing for clean energy projects

Asset-backed securities for energy efficiency and renewable energy projects offer long-term, low-volatility yields that match well with the liabilities of insurers and pension funds.

Asset-backed securities (ABS) for energy efficiency and renewable energy projects offer long-term, low-volatility yields that match well with the liabilities of insurers and pension funds. To reach a scale that is attractive to these investors, however, this market must overcome growing pains that are common to any new capital markets product. Key steps for achieving scale include: 1) minimize the due diligence burden on buyers of clean energy issues by standardizing terms for power purchase agreements; 2) make future cash flows from such issues more stable; 3) enable more accurate rating and pricing of such issues by providing more detailed historical data; and 4) limit downside risk for buyers of early clean energy ABS issues through credit enhancement by public or private banks.

7. Support development bank finance and technical assistance for emerging economies

Expanded risk insurance for clean energy investments in developing countries removes a key red flag on otherwise attractive investments. More generally, one of the ancillary benefits from helping emerging economies to embrace a low-carbon future may be significant new investment opportunities for foreign sources of capital. It's worth noting that development bank financing creates $3-15 of private investment opportunity for every $1 of public funds deployed.[59]

8. Support regulatory reforms to electric utility business models to accelerate deployment of clean energy sources and technologies

With a combined enterprise value of trillions of dollars, relatively low volatility and predictable earnings, the debt and equity of electric utilities have long been a significant share of institutional investor portfolios. But many trends are eroding the viability of traditional utility business models, which have long been premised on selling more power rather than helping ratepayers use less electricity. As stewards of trillions of dollars of capital, investors have a strong interest in ensuring that electric utilities remain financially viable in a changing landscape, where energy efficiency and distributed renewable energy are becoming bigger factors. Supporting utilities' transition to new, more sustainable business models will preserve the electric utility sector as a viable place for investors to put their capital to work.

9. Support government policies that result in a strong price on carbon pollution from fossil fuels and phase out fossil fuel subsidies

Climate change has the potential to harm long-term investor returns via 1) physical impacts, such as rising sea levels and more pronounced storms and heat waves, which can severely damage individual companies and entire economies;[60] and 2) the implementation of policies to reduce carbon emissions, which, especially if delayed for another decade or so, may come as a drastic and abrupt shock to company business models and economies at large. Adoption of economy-wide carbon prices now helps to prevent both of these risks, and enables investors to plan prudently for the transition to a low-carbon global economy. More broadly, the adoption of carbon prices and removal of fossil fuel subsidies will create supportive tailwinds across all asset classes for low-carbon investments and headwinds for high-carbon investments such as oil, gas and coal production.

10. Support policies to de-risk clean energy deployment

Policies that provide stable, long-term cash flows to clean energy projects that do not depend on unreliable and often complicated tax incentives will make clean energy significantly more attractive to institutional investors, especially as clean energy technologies approach cost competitiveness. Moreover, a focus on large-scale deployment will create investment opportunities of the size necessary for investors to justify building expertise in this new area. Finally, the lower project costs that come with increased clean energy deployment will stimulate more investment opportunities potentially worth trillions of dollars.

For further discussion of expected and historic returns from clean energy investment, please see Appendix C.

59 UNEP/SEFI, *Public Finance Mechanisms to Mobilise Investment in Climate Change Mitigation*, 2008, http://fs-unep-centre.org/sites/default/files/media/uneppublicfinancereport.pdf

60 Stern, N. Nicholas Herbert, ed. *The Economics of Climate Change: the Stern Review*. Cambridge University Press, 2007.

Recommendations

Mobilize

RECOMMENDATION 1

Develop capacity to boost clean energy investments and consider setting a goal such as 5 percent portfolio-wide clean energy investments

- **Capacity: consider developing in-house expertise to make investments in clean energy infrastructure**

Institutional investors can help build market capacity for more institutional quality and scale investment products, strategies and opportunities by communicating their interest in increasing investments in this sector across multiple asset classes (e.g. public equities, private equity, real estate and infrastructure.) One way to do this could be by adopting a clean energy investment goal—such as 5 percent of total assets allocated to clean energy within a reasonable time period. *Fulfillment of such a goal would be dependent on the funds' ability to find suitable investments across asset classes that meet their risk-return and other criteria.* Announcing such goals, even as aspirations, would send a powerful signal to the market and stimulate the development of more institutional quality and scale investment products and strategies focused on clean energy. If applied to the full $45 trillion of assets held by long-term institutional investors, a 5 percent portfolio-wide allocation would amount to $2.25 trillion of additional investment in clean energy (i.e. an amount equal to 45 percent of the "Clean Trillion" investment goal through 2020, or 17 percent of the "Clean Trillion" investment goal through 2030).[61]

CAPACITY: consider developing in-house expertise to make investments in clean energy infrastructure

For larger institutional investors who actively manage a portion of their portfolios, the most attractive clean energy opportunities may involve *direct* and *semi-direct investments* in clean energy infrastructure (e.g. via project equity, project bonds, and pooled vehicles), rather than in the stocks or corporate bonds of companies affiliated with clean energy.[62] Developing the capacity to source and execute investments in clean energy projects should therefore be a priority for institutional investors, particularly for larger funds with $50 billion or more in assets under management (AUM).[63] The Climate Policy Initiative estimates that there are 45 pension funds and 70-100 insurance companies of this size that collectively represent $25 trillion AUM (or 56 percent of total institutional investment assets under management).[64] Equipping this enormous pool of assets with investment professionals experienced in the clean energy space is a critical step for moving the needle on overall clean energy investment and adding desirable clean energy infrastructure assets to portfolios. Pension funds in Canada, northern Europe and Australia, and a number of U.S. insurance companies, have developed the capacity to do direct (and indirect via pooled investments) infrastructure investments (including in renewable energy projects), and U.S. pension funds should seek to develop similar capacity where appropriate.

61 The 45 percent and 17 percent amounts are calculated relative to the additional total investment in clean energy in a 2 degree pathway relative to a 6 degree pathway from 2010-2020 (roughly $5 trillion) and 2010-2030 (roughly $13 trillion).

62 CPI, *The Challenge of Institutional Investment in Renewable Energy*. Kaminker C. et al., "Institutional Investors and Green Infrastructure Investments: Selected Case Studies."

63 Funds with AUM less than $50 billion might focus on (1) pooling their resources to co-invest in deals, either together or alongside larger funds; or (2) investing in private equity funds focused on renewable energy infrastructure.

64 CPI, *The Challenge of Institutional Investment in Renewable Energy*, 34.

Since 10-20 percent of direct investment deals can generally be filled by smaller co-investors, funds too small to support a dedicated clean energy team should focus on (1) collaborating with larger investors to further expand the pool of available capital for clean energy deals; and (2) developing expertise in evaluating external fund managers who specialize in clean energy.

Role for external investment consultants

Limited resources will for many investors pose challenges to increasing in-house expertise in infrastructure investment. To this end, there is a pivotal role for external investment consultants to develop expertise in this area that they can then offer to pension funds, insurers, and other institutional investors seeking to invest the space. Whether with respect to sourcing and executing direct investment transactions or evaluating external fund managers, investment consultants should focus on developing the know-how and capability to advise investors on allocations to clean energy infrastructure and other investment opportunities in this sector.

Regulatory constraints

Note that for certain institutional investors (e.g. pension funds in emerging markets), reform of national regulation may be required in order to enable direct or semi-direct investment in clean energy infrastructure. Moreover, even for investors without such restrictions, the impact of new regulations (e.g. for European insurers, higher capital charges on infrastructure as a result of Solvency II) may deter increased allocations to infrastructure. For more discussion of these issues, see Appendix D.

IMPACT on Risk and Return of Clean Energy Investments

The heightened commitment and prioritization resulting from a portfolio-wide goal would give investors the best chance of capitalizing on new clean energy energy-related opportunities across all asset classes (e.g. including fixed income), as opposed to relegating this theme to just public equity or venture capital.

As noted above, clean energy projects have the potential to offer long-term, stable cash flows (often with inflation-adjustment). This asset class aligns well with the long-term funding needs and liabilities of pension funds and insurance companies, many of which are seeking to boost their infrastructure allocations for just this reason. Bolstering capacity for direct infrastructure investment will strengthen the potential to pair the cash flows of clean energy infrastructure assets with investor liabilities and funding requirements.

RECOMMENDATION 2

Elevate scrutiny of fossil fuel companies' potential carbon asset risk exposure

- **Engagement: ask fossil fuel companies to assess and reduce their exposure to carbon risk and, where necessary, redirect capital away from high-cost, high-carbon fossil fuel projects**
- **Additional measures to manage carbon asset risk**

According to the IEA, more than two-thirds of the world's proven fossil fuel reserves cannot be consumed prior to 2050 under the 2°C pathway.[65] In addition, there is growing uncertainty that future markets will mirror the past due to structural changes in energy systems and a number of existing or reasonably foreseeable market forces. Yet, in 2012 alone, the world's 200 largest publicly-traded fossil fuel companies spent $674 billion on finding and developing new reserves and associated fossil fuel infrastructure.[66] Indeed, capital expenditures in the next decade to develop new fossil fuel reserves face some of the biggest risks of becoming "stranded assets."[67] This "stranded asset risk" is part of the larger climate policy risk that Mercer has found could account for 10 percent of overall investor portfolio risk over the next twenty years.[68]

ENGAGEMENT: ask fossil fuel companies to assess and reduce their exposure to carbon risk and, where necessary, redirect capital away from high-cost, high-carbon fossil fuel projects

Investors should assess whether their portfolio energy companies are adequately preparing for a low-carbon future and that shareholder capital is not being wasted on new fossil fuel reserves that may become stranded assets. As part of the Carbon Asset Risk Initiative led by Ceres and the Carbon Tracker Initiative, with support from the Investor Network on Climate Risk, the UK/EU Institutional Investors Group on Climate Change (IIGCC), the AU/NZ Investor Group on Climate Change and other investor groups, 70 institutional investors (representing nearly $3 trillion in assets) recently wrote to 45 of the world's largest companies in the oil & gas, coal, and electric power sectors, asking for an analysis of how their business plans will fare in a carbon-constrained world versus a world of unmitigated climate change.[69] Specifically, these investors asked for an assessment of the following under both a business-as-usual scenario and a low-carbon scenario consistent with reducing GHG emissions by 80 percent by 2050 to achieve the 2° C goal: the viability of capital expenditure plans for finding and developing new reserves; the risk that some present and future reserves may become stranded assets; and the physical risk that climate change poses to operations.

Where risks are identified, investors should encourage companies to explore strategies to better *manage* those risks and ensure that future spending will generate sufficient and safe capital returns. Companies may opt in the end to *(1) return more capital to shareholders; or (2) in certain cases, redirect capital away from new and potentially unusable fossil fuel reserves and toward clean energy resources that serve as a "climate hedge."*[70]

Redirecting even a small percentage of annual corporate capital expenditures away from fossil fuels toward clean energy will have an enormous impact, helping to protect investments from market uncertainty while

65 IEA, *World Energy Outlook 2012*, (Paris: OECD/IEA, 2012), 34-35.

66 Carbon Tracker Initiative and the Grantham Research Institute, *Unburnable Carbon 2013: Wasted Capital and Stranded Assets*, 4.

67 Carbon Tracker Initiative and Grantham Research Institute, *Unburnable Carbon 2013: Wasted Capital and Stranded Assets*, 5-6. Generation Foundation, *Stranded Carbon Assets: Why and How Carbon Risks Should Be Incorporated in Investment Analysis*.

68 Mercer, *Climate Change Scenarios—Implications for Strategic Asset Allocation*, 1.

69 Ceres press release, "Investors ask fossil fuel companies to assess how business plans fare in low-carbon future," October 24, 2013, http://www.ceres.org/press/press-releases/investors-ask-fossil-fuel-companies-to-assess-how-business-plans-fare-in-low-carbon-future

70 This may be most relevant to sub-sectors of clean energy investment in which the participation of fossil fuel companies can accelerate commercial progress, such as biofuels for oil companies, CCS for coal-heavy utilities.

unlocking a largely untapped resource for clean energy investment. For sub-sectors of clean energy investment in which the participation of fossil fuel companies can accelerate commercial progress—biofuels for oil companies, CCS for coal-heavy utilities, for example—investors should especially press companies on their plans for investment.

ADDITIONAL MEASURES to Manage Carbon Asset Risk

In addition to engaging with fossil fuel companies, there are other opportunities for investors to reduce exposure of their portfolios to carbon asset risk. Implementation of such measures is likely to improve the overall framework supporting clean energy investment. For example, following the recommendations of Mercer's 2011 report on climate implications for strategic asset allocation, investors should consider:[71]

- Including assessment of climate risk in periodic strategic reviews;
- Adopting sustainability-themed indices for passive portfolios;
- Urging investment consultants and external fund managers to proactively evaluate and manage climate risks and seek appropriate clean energy investment opportunities.

Note the essential role of investment consultants and external fund managers in implementing the above measures; if institutional investor portfolios are to be repositioned toward clean energy, all parties in the investor ecosystem must contribute to this goal.

IMPACT on Risk and Return of Clean Energy Investments

A number of factors—such as future action on climate change and demand reduction from increased efficiency, renewables deployment and fuel switching—may lead to significant write-downs on the value of fossil fuel assets. In short, the risk of such stranded assets creates a material concern for long-term shareholders.[72] Returning capital to shareholders and shifting capital away from high-cost, high-carbon fossil fuel projects are ways to mitigate this risk and help to preserve long-term shareholder value while also helping to mitigate the systemic economic risks posed by climate change.

71 For more discussion of these measures, see Mercer, *Climate Change Scenarios—Implications for Strategic Asset Allocation*, 2.

72 Carbon Tracker Initiative and Grantham Research Institute, *Unburnable Carbon 2013: Wasted Capital and Stranded Assets*, 5-6.

RECOMMENDATION 3

Engage portfolio companies on the business case for energy efficiency and renewable energy sourcing, as well as on financing vehicles to support such efforts, urging them to:

- **Reduce energy use and emissions through investments in energy efficiency**
  - **When evaluating energy efficiency investments, emphasize internal rate of return instead of simple payback period**
- **Set targets to generate or procure renewable energy**
  - **Deploy innovative technology**
- **Fund investments via retained earnings or consider issuing "climate bonds"**

As large and sophisticated energy consumers, companies are well positioned to stimulate demand for renewable energy and energy efficiency—and improve their long-term financials in doing so. Consistent with expectations in the *Ceres Roadmap for Sustainability*, businesses worldwide seeking to enhance their competitiveness in the emerging low-carbon global economy need to:

- Reduce greenhouse gas emissions by 25 percent from a 2005 baseline by 2020[73]
- Improve energy efficiency of operations by at least 50 percent by 2020
- Reduce electricity demand by at least 15 percent by 2020
- Obtain at least 30 percent of energy from renewable sources by 2020

Recognizing the business case for such action, investors should encourage their portfolio companies to set and achieve such targets and to report to investors on the progress and financial impacts of such efforts. Part of this involves conveying to companies the crucial role that a Board of Directors plays in oversight of corporate sustainability programs; reflecting this reality, sustainability performance results should be a core component of executive compensation packages and incentive plans.[74]

REDUCE Energy Use & Greenhouse Gas Emissions through Investments in Energy Efficiency

Reducing energy use can help both the environment and the bottom line—and, as a result, should be the first priority of any corporate environmental sustainability program. A 2010 McKinsey study found that investing $520 billion in energy efficiency measures could save the United States $1.2 trillion through 2020, with nearly two-thirds of these savings accruing to businesses.[75] To achieve greater energy efficiency, companies should (1) systematically measure energy use in operations; (2) set targets for absolute reduction in energy use (both company-wide and within specific divisions), as well as interim goals; and (3) develop and prioritize energy reduction strategies and allocate sufficient capital and human resources to support long-term investment in energy efficient technologies and processes.

Looking beyond simple payback period to internal rate of return (IRR)

Businesses can expand the universe of attractive investments in energy-efficiency by reducing emphasis on the *simple payback period* as the metric for judging potential investments. Reliance on a simple payback period (number of years for an initial capital investment to be "paid back" via reduced

73 Ceres, *The Road to 2020: Corporate Progress on the Ceres Roadmap for Sustainability*, March 11, 2010, http://www.ceres.org/resources/reports/the-road-to-2020-corporate-progress-on-the-ceres-roadmap-for-sustainability/view Sustainability Roadmap. Ceres' "expectations" aligned with scientific targets that call for the U.S. to achieve GHG emission reductions of 80 percent below 1990 baseline levels by 2050 and at least 25 percent reduction below 1990 by 2020. This expectation uses 2005 as the baseline,

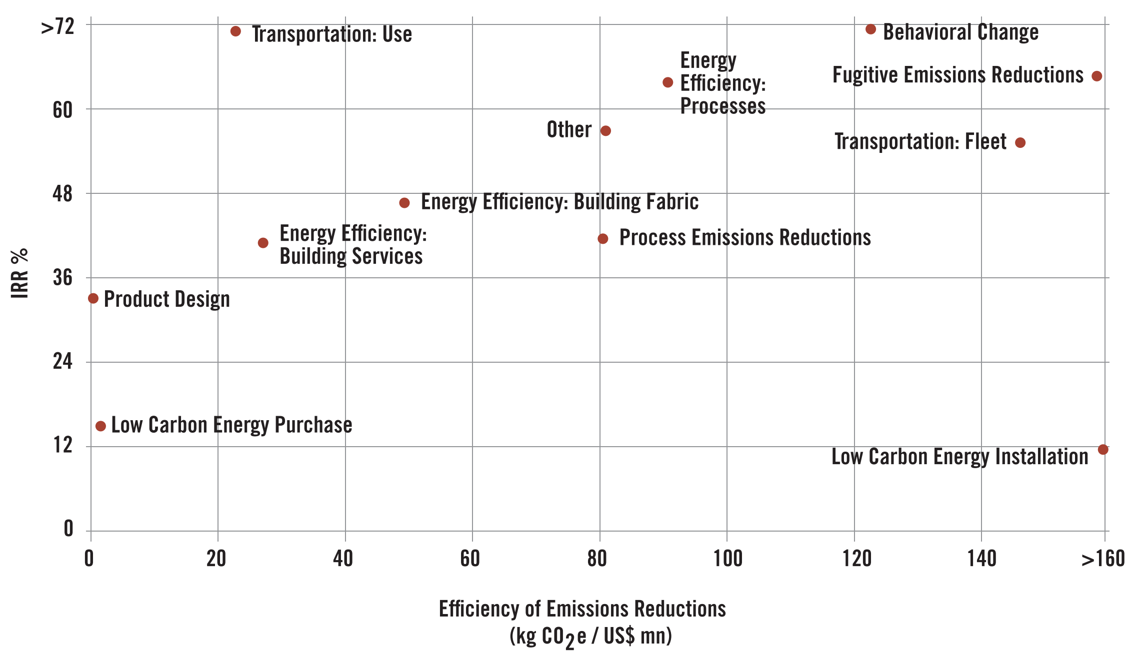
74 Ibid.

75 McKinsey & Company, *Unlocking Energy Efficiency in the US Economy*, July 2009, http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/unlocking_energy_efficiency_in_the_us_economy.

operating costs) diminishes the attractiveness of projects that require large capital outlays up-front, even when projects yield cost-savings that are large, stable, and predictable.[76] Surveys show that executives and managers in many industries require rapid payback periods on energy efficiency projects, ranging from less than three years in diversified industrial companies to less than 18 months in commercial real estate companies.[77] Such short time horizons are likely causing businesses to overlook many highly profitable energy efficiency investment opportunities. Encouraging managers to focus on projects with high internal rates of return (IRR)[78]—even at the cost of longer payback of upfront investment—will enable businesses to capture more highly profitable cost-savings opportunities.

Examples of such high potential opportunities are outlined in the CDP's 2012 Carbon Action Report.[79] Analyzing 860 emissions-reduction activities across a sample of 256 companies, the report shows how investment in building, process, and transportation efficiency yield median IRRs in the range of 40-65 percent. Investments in improving the efficiency of transportation fleets were found to yield both attractive IRRs (median IRR above 50 percent) along with significant carbon emission reductions. Project-level returns on building, process and transportation efficiency investments nearly always exceeded firm-level returns on invested capital.[80] *The bottom line: regardless of environmental benefits, energy efficiency investments offer significant opportunities for companies to create shareholder value.* It's worth noting that across all of its 860 emissions-reduction activities, CDP calculated an average payback period of three years. This finding shows how requiring energy efficiency projects to meet arbitrary payback deadlines (e.g. two years) can cause businesses to miss opportunities for financial gain that are significantly better than their IRR on many core business activities.

FIGURE 8: RETURN ON INVESTMENT FOR EMISSIONS REDUCTION ACTIVITIES



Source: CDP, Carbon Action Report 2012 based on company data. Note: the figures in the exhibit above are based on 238 emissions reduction activities reported by sample of 256 companies in heavy emitting industries. Median IRR and efficiency of CO2e reductions are calculated based on figures reported to Investor CDP in 2012.

76 Peretz, Neil. "Growing the Energy Efficiency Market Through Third-Party Financing." Energy LJ 30 (2009): 377.

77 Johnson Controls Institute for Building Efficiency, "2010 Energy Efficiency Indicator Global Survey Results," June 3, 2010, http://pacenow.org/wp-content/uploads/2012/07/EEI-2010-Global-Executive-Summary-ENG.pdf. Matthew Wheeland, "Real Estate Portfolio Managers Find Millions of Reasons to Go Green," May 5, 2011, GreenBiz.com, http://www.greenbiz.com/news/2011/05/05/real-estate-portfolio-managers-find-millions-reasons-go-green.

78 A project's internal rate of return (IRR) is the discount rate that—when applied to project cash flows—yields a net present value of zero.

79 CDP, *Carbon Action Report 2012*, 2012, https://www.cdp.net/CDPResults/CDP-Carbon-Action-Report-2012.pdf

80 Return on Invested Capital (ROIC) = Net operating profit after tax divided by fixed assets + non-cash working capital

SET TARGETS to Generate or Procure Renewable Energy

In addition to using less energy, companies should also seek to increase energy sourcing from renewable energy. Diversifying energy supplies to include low or zero-marginal cost renewable resources can benefit businesses by (1) creating a hedge against volatile fossil fuel and electricity prices; and (2) reducing energy-related operating costs. For energy companies, this likely means setting targets for renewable energy production and allocating sufficient levels of capital to boost renewable generation over time. Companies not in the energy business may have the opportunity to deploy on-site renewable generation.

- As part of a partnership with commercial solar provider *SunEdison*, the office supply store chain *Staples* hosts 37 active solar arrays on its rooftops.[81] Combined with purchases of green power, these rooftop solar arrays enable Staples to supply 100 percent of its total U.S. electricity consumption through renewable power sources. This is an example for other companies both in retail and other sectors to emulate.
- As part of its commitment to use 100 percent renewable energy, *Walmart* has completed or is developing 180 renewable energy projects at its facilities, including 150 solar installations in seven countries and 26 fuel cell installations in the U.S.[82]

Deploying Innovative Technology

By boosting on-site renewable generation, companies also have an opportunity to deploy first-of-a-kind, innovative technologies. In 2008 Google became the first customer to deploy Bloom Energy's solid oxide fuel cell ("Bloom Box"), with other major companies such as eBay, the Coca-Cola Co., Honda and Verizon subsequently doing the same.[83] This and other examples illustrate the unique ability of companies to provide high-profile test-beds for innovative clean energy technologies.

FUND INVESTMENTS via Retained Earnings or Consider Issuing "Climate Bonds"

With companies sitting on record amounts of capital—over $1 trillion for companies in the S&P 500 alone[84]—most larger public companies should have ample resources on hand to fund the initial cost of energy efficiency and renewable energy investments. That said, to the extent that additional capital is needed, companies might consider issuing bonds linked to specific energy efficiency or renewable projects. For example, the French utility EDC recently issued a $1.9 bond to finance project development by EDF's renewable energy unit, EDF Energie Nouvelles.[85] Strong demand for such issues—the EDF deal was oversubscribed by 2X, and 13 percent of the investor base came from pension funds and insurance companies[86]—suggests that companies with sound plans for clean energy investment will be able to tap into large pools of external capital.

81 Staples news release, "Staples and SunEdison Unveil Solar Power Installation at Staples Global Headquarters," April 25, 2013, http://investor.staples.com/phoenix.zhtml?c=96244&p=irol-newsArticle&ID=1811242&highlight=

82 Walmart, "Renewable Energy," http://corporate.walmart.com/global-responsibility/environment-sustainability/renewable-energy, accessed December 23, 2013.

83 Bloom Energy, "Company History," http://www.bloomenergy.com/about/company-history/, accessed December 23, 2013.

84 Bob Pisani, "Companies sitting on cash pile of over $1 trillion," CNBC, July 26, 2013, http://www.cnbc.com/id/100911328.

85 Climate Bonds Initiative blog, "Nov review 6/7: And then came the whopper…. EDF's EUR 1.4 bn," December 9, 2013, http://www.climatebonds.net/2013/12/nov-review-67-and-then-came-the-whopper-edfs-eur1-4bn/

86 Climate Bonds Initiative blog, "EDF closes humdinger EUR1.4bn green bond, A+, 7.5yr—2x oversubscribed. Wow! This is how investors vote," November 21, 2013, http://www.climatebonds.net/2013/11/edf-closes-a-7-5yr-humdinger-eur1-4bn-green-bond-2-x-oversubscribed/.

☑ ROLE for Investors

Investors should engage with companies to encourage greater investment in energy efficiency and renewable energy. Specific areas for engagement include:

- ✓ Reviewing corporate sustainability goals to ensure that goals related to energy efficiency and renewable energy use are in line with best-in-class companies
- ✓ Asking companies to make sustainability performance results a core component of executive compensation packages and incentive plans
- ✓ Developing quantitative targets for devoting a portion of retained earnings to financing energy efficiency and renewable energy
- ✓ Encouraging companies to include a "shadow price" on carbon emissions in their long-term financial plans, as 29 of America's largest companies have recently begun doing[87]
- ✓ Asking companies to demonstrate how they quantify the benefit of reduced exposure to fuel price volatility and incorporate this benefit into project assessments
- ✓ Urging companies to focus on IRR as opposed to simple payback periods when evaluating energy efficiency investments

IMPACT on Risk and Return of Clean Energy Investments

Encouraging companies to aggressively pursue energy efficiency opportunities can help to unlock projects with high return on invested capital, thereby creating shareholder value. Moreover, in using clean energy resources to minimize carbon emissions companies will (1) reduce vulnerability to future carbon regulation (thereby protecting against future cost increases); and (2) possibly identify new business opportunities or customer solutions (thereby increasing future revenues). Both of these reasons underpin the conclusion of academic research that, over the long term, companies with leading environmental performance tend to also deliver superior financial returns for investors.[88]

87 For more discussion of this point, see Recommendation 9.

88 DB Climate Change Advisors, *Sustainable Investing: Establishing Long-Term Value and Performance*, May 2012, https://www.dbadvisors.com/content/_media/Sustainable_Investing_2012.pdf

RECOMMENDATION 4

Support efforts to standardize and quantify clean energy investment data and products to improve market transparency

- **Participate in disclosure initiatives such as the Global Registry of Low-Carbon Investments**
- **Support standardization initiatives such as the Climate Bond Standard and Certification Scheme and the Green Bonds Principles**

For most assets that pension funds and insurance companies invest in—stocks, bonds and commodities—a wealth of data is readily available. That's not the case for clean energy infrastructure assets, which suffer from a lack of data on historical pricing and even basic asset ownership. Notwithstanding valuable data available from the IEA, BNEF, UNEP Finance Initiative, International Renewable Energy Agency (IRENA) and Renewable Energy Policy Network for the 21st Century (REN21), and the Climate Policy Initiative, it is difficult to find data on the underlying source of funds by type of institution (e.g. pension fund, insurance company). Additionally, even for asset classes on which data is available (e.g. bonds), there is no agreed-upon definition for what constitutes a "climate-themed" investment. Indeed, the varying definitions of what is the "Clean Trillion" and how to fully measure it in a timely fashion illustrate the point. To remedy this situation, investors should (1) participate in emerging disclosure initiatives such as the Global Registry of Low-Carbon Investments; and (2) support standardization initiatives such as the Climate Bond Standard and Certification Scheme, the Green Bonds Principles, and the joint multilateral development bank (MDB) approach for reporting on climate mitigation finance.

DISCLOSURE Initiatives

One barrier to scaling up clean energy investment is a lack of information. Currently there is available data on the use of funds (e.g. by asset class, technology and region), but insufficient data on the source of funds (e.g. what kinds of investors are supplying the funds).[89] As is the case for many other types of infrastructure, current data on the source of funds for clean energy projects—for example, ABC infrastructure fund supplied $50 million of equity to XYZ wind project—provide only a snapshot at the time of financing and do not show the ultimate underlying holders of the assets (for example, specific investors in the ABC infrastructure fund).[90] Conversely, for other asset classes (e.g. sovereign debt) detailed information on the source of funds is commonly recorded by national statistical offices. Lack of market data stymies investment by making it difficult to assess potential buyers of renewable energy projects should they need to be sold on short notice. This data void, in turn, makes positions in clean energy projects and funds appear less liquid than they actually are, thus deterring investment.

Investors can help resolve this data gap by participating in new disclosure initiatives such as the Global Registry of Low-Carbon Investments.[91] Open to institutional investors from around the world, with participants in the recent *Global Investor Survey on Climate Change*[92] contributing the initial data, the Registry will publish initial data in early 2014 on low-carbon investments. Participants will have the opportunity to report in greater detail on when capital in their portfolios is being allocated to a low-carbon purpose. Evidence of investors putting money to work in clean energy has the potential to start a virtuous circle galvanizing policymakers and other investors to take action that further increases low-carbon capital allocations.

89 Mark Fulton, "Climate finance: where is the missing data," *The Guardian*, August 19, 2013, http://www.theguardian.com/sustainable-business/climate-finance-missing-data-sources

90 Clapp, Christa, Jane Ellis, Julia Benn, and Jan Corfee-Morlot. "Tracking Climate Finance: What and How?." *Paris: OECD*. http://www.oecd.org/environment/climatechange/50293494.pdf (2012).

91 Ceres, "20 trillion global investor coalition on climate change meeting in Hong Kong puts the spotlight on Asia's contribution to climate change and on climate solutions," June 19, 2013, http://www.ceres.org/press/press-releases/20-trillion-global-investor-coalition-on-climate-change-meeting-in-hong-kong-puts-the-spotlight-on-asia2019s-contribution-to-climate-change-and-on-climate-solutions.

92 IIGCC/Ceres/IGCC/AIGCC, "Global Investor Survey on Climate Change: 3rd Annual Report on Actions and Progress," August 5, 2013, http://www.ceres.org/resources/reports/global-investor-survey-on-climate-change-2013/view.

STANDARDIZATION Initiatives

In addition to the Low-Carbon Investment Registry, institutional investors should also support other efforts to standardize definitions of what constitutes a "climate-themed" investment. Nowhere is this more critical than in the $78 trillion global bond market.[93] As of June 2013, HSBC and the Climate Bonds Initiative estimated there were $346 billion of outstanding "climate-themed" bonds (with issuers ranging from multilateral development banks to electric utilities), and the largest project category being rail transit (largely in China).[94] However, there is no universally agreed-upon definition for what constitutes a "climate-themed" bond. Investors should remedy this by supporting emerging certification standards such as the Climate Bond Standard and Certification Scheme,[95] voluntary guidelines such as the Green Bonds Principles, proposed by banks including Bank of America Merrill Lynch and Citi,[96] and reporting frameworks such as the joint MDB approach for reporting on climate mitigation finance.[97]

By defining criteria for a "climate-themed" bond, the Climate Bond Standard allows for the straightforward certification of project, portfolio, corporate and sovereign bonds tied to assets contributing to a low-carbon economy.[98] Such a straightforward certification process will help make climate-related products more liquid and comparable—traits that "climate-themed" bonds must have if they are to occupy a significant position in investor portfolios. Such standards are necessary to ensure the credibility of "climate bonds" and the growth of the global green bonds market. Additionally, they will help to prevent the likelihood of so-called "greenwashing" by issuing bonds under a climate-themed heading without actually linking use of proceeds to recognized mitigation or adaptation initiatives.

☑ ROLE for Investors

As holders of much market information, investors—by participating in disclosure initiatives—can play a leading role in making markets for clean energy more transparent. Participation in standardization efforts is just as essential.

IMPACT on Risk and Return of Clean Energy Investments

Standardizing definitions of key investment terms (e.g. what constitutes a "climate bond") will minimize the due diligence burden on investors and reduce the transaction costs of investing in newer clean energy-related products; similarly, by reassuring potential buyers about what they are purchasing, standardization will increase the liquidity of climate bonds and other products. More data on clean energy investment generally will enable more precise benchmarking and evaluation of potential deals.

93 Climate Bonds Initiative blog, "9 useful facts about the global bond market," Feb 27, 2013, http://www.climatebonds.net/2013/02/9-useful-facts-bond-markets/.

94 Climate Bonds Initiative and HSBC, *Bonds and Climate Change: The State of the Market 2013*, 2. Note that this $74 billion figure includes many sector categories (e.g. Rail Transport, Agriculture and Forestry, Waste and Pollution Control) not included in the BNEF definition of "clean energy" used in this paper.

95 Climate Bonds Standard, "Process," http://standards.climatebonds.net/how-it-works-2/certification-2/, accessed December 23, 2013.

96 Euro Week, "Framework for Green Bonds," http://www.euroweek.com/SpecialReportsArticle.aspx?IssueID=89995&ArticleID=3260887&isAsia=&single=true, accessed December 23, 2013. The Citi/BAML Green Bonds Framework contains seven sections that address (i) definition of green bonds; (ii) criteria for use of proceeds; (iii) issuer's process for project evaluation; (iv) management of proceeds; (v) additional assurance; (vi) reporting; and (vii) central forums for defining appropriate use of proceeds.

97 AfDB/ABD/ERBD/EIB/IDB/ IFC/World Bank, "Joint MDB Report on Mitigation Finance 2011," June 2012, http://climatechange.worldbank.org/sites/default/files/MMF_2011_version_21.pdf

98 For example, the Climate Bonds Standard proposes that in the case of corporate bonds "a simple, low-cost ring-fencing exercise is required to assure that the funds raised by the bond are backed by a pool of climate-credible assets. Bonds are verified by a third-party provider that they conform with the Standard and then certified by the Climate Bond Standards Board."

RECOMMENDATION 5

Encourage "green banking" to maximize the flow of private capital into clean energy

- **National/multilateral development banks should increase issuances of climate bonds**
- **Provide credit enhancement to clean energy project bonds**
- **Pass legislation authorizing banks to issue clean energy "covered bonds"**

Banks, businesses and policymakers can all take key steps to promote the flow of private capital into clean energy. Key focus areas include (1) development banks and other state-affiliated financial institutions issuing "climate bonds" linked to clean energy projects (with use of proceeds satisfying recognized criteria such as the Climate Bonds Standard or World Bank green bonds criteria); (2) using public funds to provide loan-loss reserve funds, subordinated debt and other measures to enhance the creditworthiness of clean energy asset-backed securities; and (3) passing legislation authorizing banks to finance clean energy projects through the use of covered bonds.

INCREASE ISSUANCES of climate bonds by both national/multilateral and commercial banks

With a value of $78 trillion and a 33-73 percent share of institutional investor portfolios,[99] the global bond market offers the greatest opportunity to raise large amounts of capital for clean energy investment. As we discuss below and in Recommendation 6, the most common route to accessing the bond market is issuance of project bonds and asset-backed securities. Through at least 2020, however, an equally important route is through national or international financial institutions like the World Bank, IFC and EBRD issuing "climate bonds" whose proceeds go to projects that help mitigate climate change. Unlike asset-backed securities, these bonds are not tied to the cash flows from specific projects, but instead can benefit from the AAA ratings of the issuing institutions, enabling them to be immediately put into institutional investor portfolios.

Since 2008, the World Bank has issued about $4 billion in green bonds to support solar and wind installations, construction of energy-efficient buildings and other low-carbon development projects.[100] Other multilateral development banks have followed suit, including the International Finance Corporation (IFC), the Export-Import Bank of Korea (Kexim), and the African Development Bank (AfDB),[101] bringing the total amount of outstanding green bonds/climate bonds from multilateral development banks to roughly $10 billion.[102] Given strong investor demand for recent offerings, which were oversubscribed in a matter of hours and included significant demand from mainstream U.S. and European investors, multilateral and government-affiliated banks should substantially increase issuances of climate bonds.[103] Issuances from multilateral banks will help prime the market for climate bond offerings from traditional commercial and investment banks. This latter development has already begun, with Bank of America in November 2013 issuing a $500 million three-year bond to finance renewable energy and energy efficiency projects.[104] Adopting a common standard for the use of funds from climate bonds will further stimulate investor demand and help build a credible global green bonds market.

99 OECD, "Annual Survey of Large Pension Funds and Public Pension Reserve Funds," October 2013, http://www.oecd.org/daf/fin/private-pensions/LargestPensionFunds2012Survey.pdf

100 World Bank, "Green Bond Fact Sheet," August 2013, http://treasury.worldbank.org/cmd/pdf/WorldBankGreenBondFactSheet.pdf

101 African Development Bank Group, "AfDB Launches 3-year U.S. $500 million inaugural bond," All Africa sponsor wire, October 11 2013, http://allafrica.com/stories/201310140761.html.

102 Climate Bonds Initiative, personal communication, November 2013.

103 For example, the Climate Bonds Initiative (CBI) proposes a 2020 target for development bank issuance of $100 billion per year. CBI arrives at this figure on the premise that, by 2020, 50 percent of development bank lending ought to go to climate-themed projects (i.e. to loans against which climate-themed bonds could be issued).

104 Bank of America, "Bank of America Issues $500 Million 'Green Bond,'" November 21, 2013, http://newsroom.bankofamerica.com/press-releases/corporate-and-financial-news/bank-america-issues-500-million-green-bond.

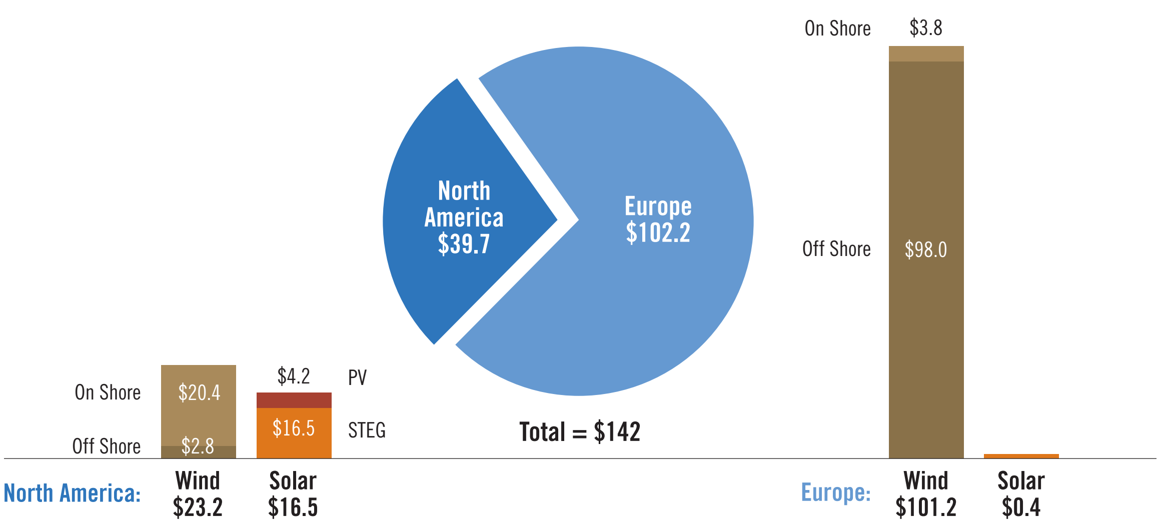
FIGURE 9: BREAKDOWN OF CLIMATE/GREEN LABELLED BOND PROGRAMS (2012 AMOUNT OUTSTANDING)

Source: HSBC, Climate Bonds Initiative

PROVIDE Credit Enhancement for Clean Energy Project Bonds

The market for clean energy project bonds is poised to grow. As of November 2013, utility-scale clean energy projects (mostly for wind and solar) had issued over $7 billion of project bonds to insurance companies, pension funds and other investors.[105] Given the pipeline of 225 utility-scale (i.e. 95 megawatts and above) wind and solar projects in the U.S. and Europe, Bloomberg New Energy Finance estimates a potential clean energy bond market of $142 billion, with bond issuances of $18-$40 billion annually by 2020 (up from roughly $2 billion today).[106]

FIGURE 10: ESTIMATED PROJECT BOND PIPELINE FROM UTILITY-SCALE WIND & SOLAR PROJECTS IN THE U.S. & EUROPE (IN $ BILLIONS)



Source: OECD chart and analysis based on BNEF data file.

To be investable by institutional investors, however, bonds backed by revenues from clean energy projects must be rated as "investment grade."[107] Limited performance history, however, can make this rating difficult for some projects to attain. Policymakers can address this problem and accelerate issuance of clean energy project bonds by using public funds to provide "credit enhancement" to such

105 BNEF, "Green Bonds Market Outlook 2013: Ripe pickings at the green bond market," 2013. Note that the $7 billion figure includes only a portion of private placement debt and that the actual figure for outstanding clean energy project bonds could be significantly higher.

106 BNEF, "Green Bonds Market Outlook 2013: Ripe pickings at the green bond market," 2013. Note that including potential bond issuances from portfolios of rooftop solar PV or onshore wind projects increases the potential market size even further.

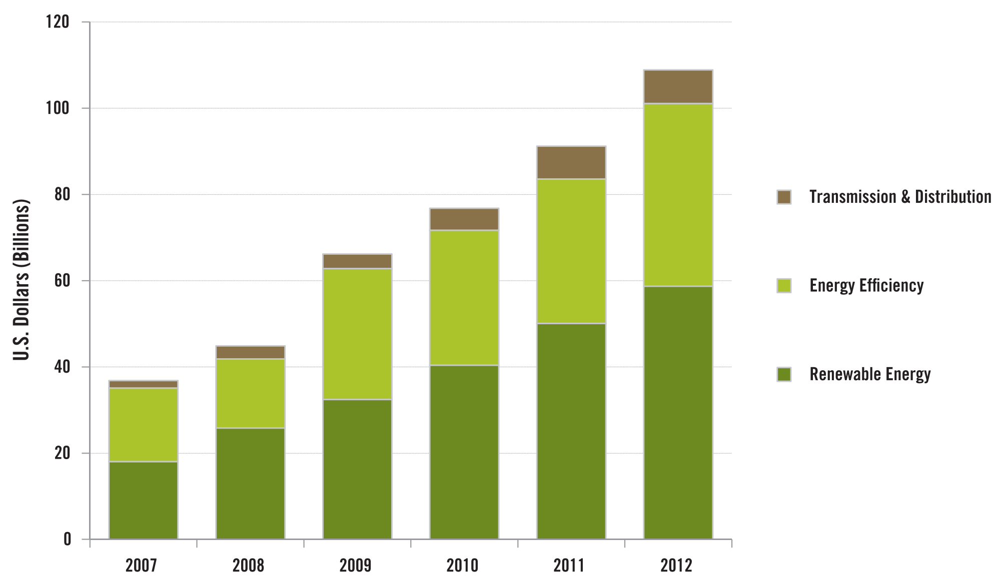
107 A bond is considered to be "investment grade" if it is rated BBB- or higher by Standard & Poor's or Baa3 or higher by Moody's. See Standard & Poor's, "Credit Ratings Definitions & FAQs," http://www.standardandpoors.com/ratings/definitions-and-faqs/en/us, accessed December 23, 2013. Also Moody's Investor Service, "Moody's Rating Symbols & Definitions," June 2009, 12-14, https://www.moodys.com/sites/products/AboutMoodysRatingsAttachments/MoodysRatingsSymbolsand percent20Definitions.pdf.

issues. By reducing the probability of investor losses, publicly funded subordinated debt or loan-loss reserve facilities[108] will improve the creditworthiness of clean energy project bonds and bolster investor demand. For example, New York State's new $1 billion Green Bank Initiative, offering subordinated debt and loan-loss reserve facilities to renewable energy and energy efficiency projects, estimates that over 20 years such credit enhancement techniques can leverage $5-10 of total clean energy investment for every $1 of public funds.[109] Similar initiatives are underway elsewhere in the U.S. and U.K., suggesting an emerging model for other countries to replicate. Regional initiatives to provide credit enhancement across multiple sectors, such as the €5bn Europe 2020 Project Bonds Initiative (PBI),[110] should also be modified or expanded to include greater allocations to clean energy projects.

The role of development banks

Key players in financing clean energy investment are *development banks* at the multilateral (World Bank Group), regional (European Investment Bank), and national (Germany's KfW, the China Development Bank, etc.) levels. From 2007-2012, these institutions invested $396 billion in renewable energy and energy efficiency, an amount equivalent to roughly 28 percent of global clean energy investment over this period.[111]

FIGURE 11: DEVELOPMENT BANK CLEAN ENERGY INVESTMENT ($BN)



Source: Bloomberg New Energy Finance

Development banks are major players in funding clean energy projects in both emerging *and* developed economies. From 2007-2012, KfW and the European Investment Bank together deployed $202 billion toward clean energy in Europe. Funding from the China Development Bank ($77.8 billion from 2007-2012) and the Brazilian Development Bank ($46.8 billion from 2007-2012) makes these institutions similarly dominant in the clean energy financing landscapes of their home markets.[112]

108 By being first in line to assume losses, subordinated debt reduces the probability of loss for senior debt. A loan-loss reserve facility is a pool of funds set aside to cover a maximum portion of losses (e.g. 10-20 percent) on a specified pool of loans.

109 Booz Allen & Company, "New York State Green Bank: Business Plan Development," September 3, 2013, http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={52B09652-1BA1-4B85-845C-B6F05185E692}.

110 European Investment Bank, "The Europe 2020 Project Bond Initiative," November 7, 2012, http://www.eib.org/attachments/press-news-the-europe-2020-project-bond-initiative-07112012-en.pdf. Note that most PBI funds are currently slated for projects not related to clean energy (e.g. roads and gas pipelines), with the UK's transmission links to offshore wind farms being at this time the sole clean energy-related investment eligible for PBI funding.

111 BNEF, "Development Banks—breaking the $100bn-a-year barrier," *BNEF Clean Energy White Paper*, 3 September 10, 2013, http://about.bnef.com/white-papers/development-banks-breaking-the-100bn-a-year-barrier/.

112 BNEF, "Development Banks—breaking the $100bn-a-year barrier," 6. All figures include a small portion of funding for T&D investment.

This scale and experience positions these institutions to successfully provide credit enhancement to clean energy project bonds. As a complement to their traditional focus on low-cost direct loans and other forms of concessionary finance, these institutions should prioritize opportunities to use their balance sheets in support of clean energy and energy efficiency bonds. [113]

PASS LEGISLATION Authorizing Banks to Issue Clean Energy "Covered Bonds"

Between AAA-rated climate bonds issued by multilateral development banks and asset-backed securities reliant solely on the cash flows from clean energy projects, there is a potential middle ground, "covered bonds," issued by banks. Covered bonds employ a "dual recourse structure" where bond investors have a claim over (1) a "cover pool" of assets, the quality of which is strictly regulated; and (2) a general unsecured claim against the issuer.[114] This dual recourse structure enables covered bonds to enjoy superior credit ratings and lower funding costs compared with unsecured debt issued by banks.[115] At the same time, because of strict oversight for what can go into the "cover pool," they generally are safer for investors than pure asset-backed securities. By creating liquid assets with a lower cost of funding, covered bond legislation, which now exists in nearly 40 countries and supports a $2.5 trillion global market, has encouraged lending in designated areas such as housing and public infrastructure. Policymakers should revise covered bond legislation to allow banks to issue covered bonds based on renewable energy loans.[116] Germany, the world's largest covered bond market, has demonstrated that such legislation can be successfully revised to accommodate new asset classes (most recently, shipping and aircraft assets). Given the vital priority of financing low-carbon infrastructure, policymakers must enable covered bonds to become one of the pathways connecting the global bond market to clean energy investment.

☑ ROLE for Investors

- ✓ Investors can promote "green banking" in multiple ways.
- ✓ Communicate to commercial and multilateral development banks an appetite for climate-themed bonds
- ✓ As shareholders and lenders to commercial banks, engage to support activity in green banking
- ✓ Make the case to governments about the benefits of extending covered bonds to clean energy

IMPACT on Risk and Return of Clean Energy Investments

Expanded issuance of climate bonds by multilateral banks will expand the universe of highly-rated fixed-income products attached to clean energy, thereby making it easier for investors to increase allocations to clean energy within existing liquidity/creditworthiness constraints. Similarly, credit enhancement for project bonds will enable investors to capture the relatively higher yield of these instruments (relative to sovereign debt) while protecting against downside risk that results from a lack of historical data. Finally, the $2.5 trillion covered bond market offers attractive products for pension funds and insurers—extra yield relative to sovereign debt, but with less risk than unsecured bank debt or asset-backed securities—and extending this market to clean energy will increase opportunities for covered bonds in investor portfolios. As noted above, however, increasing allocations to the products discussed in this section would have to be done in the context of each portfolio's individual risk-return and other requirements.

113 Recommendation 7 below elaborates on the role of development banks in financing clean energy.

114 Note how this is different from pure asset-backed securities, where repayment depends on the performance of a defined pool of assets owned by a special purpose vehicle.

115 Damerow, F., Kidney, S., and S. Clenaghan, "How Covered Bond markets can be adapted for Renewable Energy Finance and how this could Catalyse Innovation in Low-Carbon Capital Markets: Unlocking bank lending in an era of capital constraint and limited public budgets, *Climate Bonds Initiative Discussion Paper,* May 2012, http://www.climatebonds.net/wp-content/uploads/2012/05/Climate-Bonds_RE-covered-bonds_22May20121.pdf

116 Specific renewable energy covered bond legislation will require many factors to be taken into account. These would include: agreeing which institutions could issue covered bonds; identification of regulatory authorities; definitions of qualifying assets; agreement on loan to-value ratios; cover pool management standards; and requirements for enforceability.

Promote

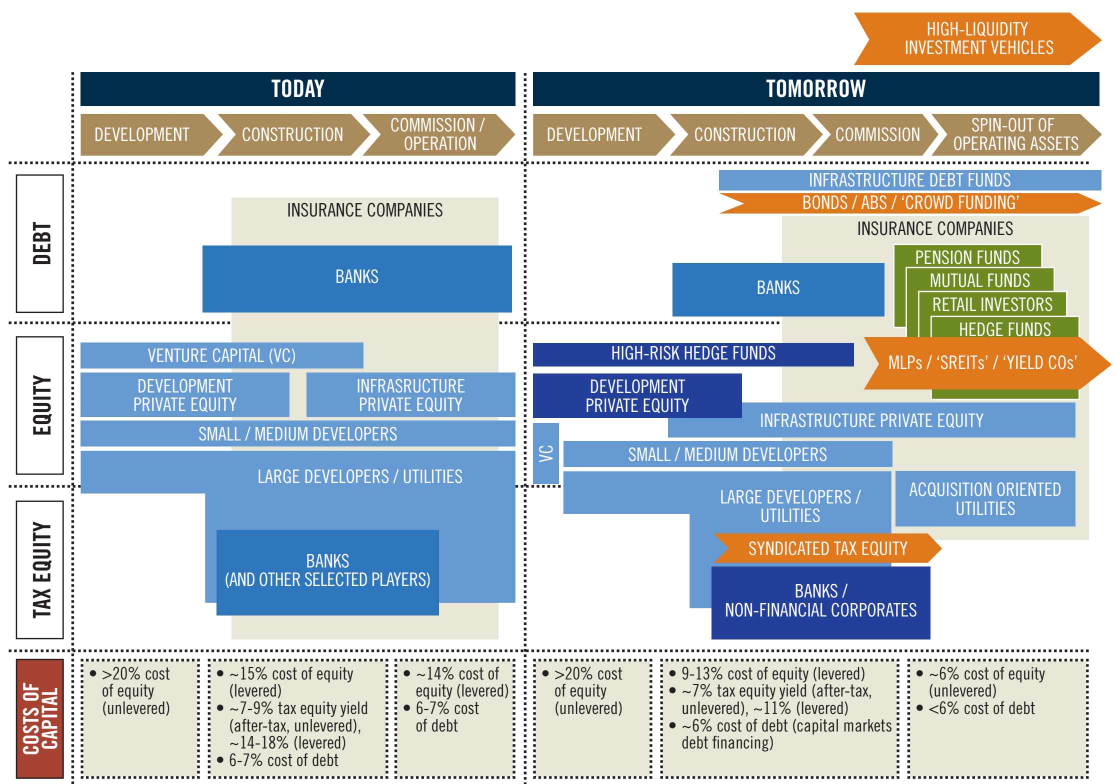
RECOMMENDATION 6

Support issuances of asset-backed securities to expand debt finance for clean energy projects

- **Standardize terms of power purchase agreements and other project documents**
- **Ensure robust supply of creditworthy operation and maintenance providers**
- **Develop detailed databases of customer default rates**
- **Use credit enhancement to develop a track record for securitized clean energy bonds**

Current methods of financing clean energy—combinations of bank debt, private equity, tax incentives, utility balance sheets and public funds—are usually still more expensive than fossil fuel financing (although the gap is closing) and currently too limited to support a doubling of annual clean energy investment by 2020. By broadening the pool of potential investors and enabling longer-term debt, access to bond markets will increase the supply of financing and lower capital costs for clean energy projects. Focusing on the case of solar in the US, the figure below illustrates how greater access to capital markets (e.g. via bonds and asset-backed securities) can increase the pool of investors and lower the cost of capital for projects.

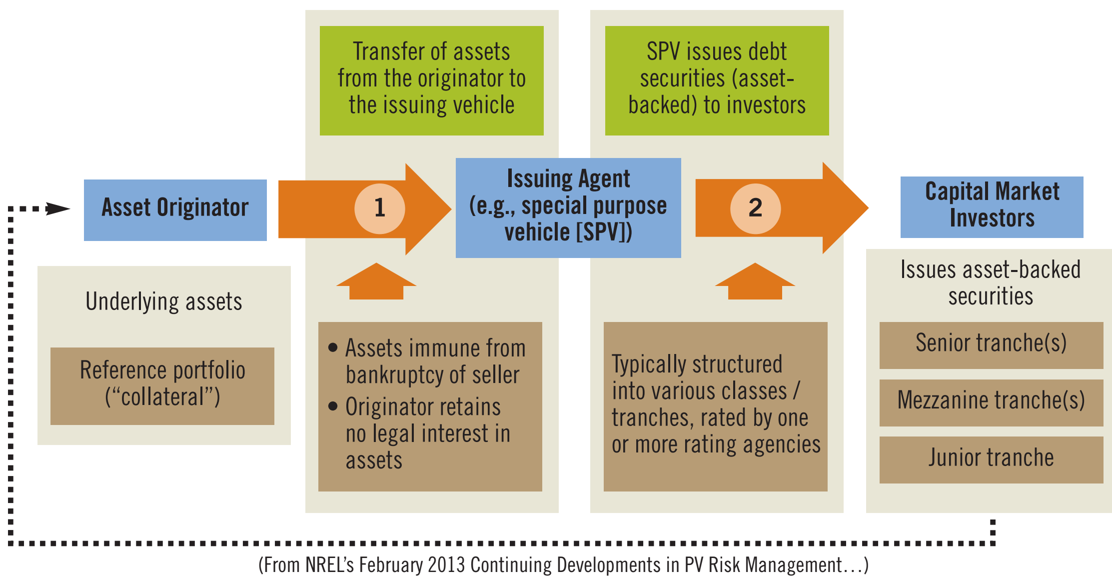
FIGURE 12: POTENTIAL EVOLUTION OF US SOLAR FINANCING



Source: Bloomberg New Energy Finance

Some clean energy projects will be large enough to individually issue bonds (as discussed above). Most projects, however, are too small to justify the expense of an individual bond issuance, requiring them to be linked to bond markets via *securitization*. Asset-backed or securitized bonds are similar to ordinary bonds but have a pool of specific assets whose revenues pay the interest and principal. While ordinary bond payments are generally guaranteed by the government or company that issues them, in asset-backed or securitized bonds a set of revenue generating assets—for example, a collection of solar PV projects—are put into a special purpose company which collects principal and interest payments and passes them through to bondholders.[117] Because many developers of clean energy projects lack the credit rating to themselves issue bonds, securitized bonds—where repayment depends on the quality of the assets rather than the creditworthiness of the issuer—have the potential to lower financing costs.

FIGURE 13: OVERVIEW OF SECURITZATION—HOW IT WORKS



Source: US National Renewable Energy Laboratory

As discussed above, however, institutional investors can usually buy an asset-backed security only if a credit rating agency has deemed the security to be "investment grade."[118] The typical structure of renewable energy and energy efficiency projects—use of proven technology, long-term contracts with creditworthy off-takers—should eventually enable asset-backed securities linked to underlying cash flows to consistently achieve investment-grade ratings. As with any new financial product, however, there are challenges to establishing the initial market, particularly for portfolios of smaller projects.[119]

STANDARDIZE terms of power purchase agreements and other contract documents

Renewable energy projects generally sell electricity to buyers (e.g. utilities, households, etc.) via long-term power purchase agreements (PPAs). The terms of such agreements, however, tend to vary across markets and geographies.[120] If a portfolio of projects is to be combined into a single pool, inconsistency

117 US National Renewable Energy Laboratory (NREL), "Solar Securitization: A Status Report," 2013, http://www.nrel.gov/docs/fy14osti/60553.pdf

118 For more discussion of "investment-grade" ratings, see note 107 above.

119 This discussion focuses chiefly on bonds from renewable energy projects such as solar PV installations. Most of the underlying points, however, will also apply to bonds linked to energy efficiency retrofit projects.

120 For example, in the case of utility-scale projects, Fitch Ratings notes that "Some PPAs have a simple requirement that the utility offtaker purchase whatever electric energy output the project produces. Other PPAs have more stringent requirements that the project has to achieve minimal performance thresholds regarding the plant's availability and capacity factors and total electric energy output." Fitch Ratings, "Rating Criteria for Solar Power Projets," February 23, 2012, 13. Similar variance in terms is typical of residential and commercial PPAs.

in the terms of PPAs complicates the task of assigning a credit rating. Developers of wind and solar projects must focus on standardizing the terms of PPAs. Progress is being made on this front through industry working groups such as Solar Access to Public Capital (SAPC), a forum convened by the U.S. National Renewable Energy Laboratory (NREL). SAPC having recently completed and released its first set of standardized contract documents for residential and commercial PPAs,[121] the next step is to ensure use of these standardized terms in as many future PPAs as possible.

ENSURE a robust supply of creditworthy operation and maintenance providers

Given the long-term nature of the revenue-generating assets in potential clean energy project bonds, cash flows from these bonds rely on the assets operating at an assumed capacity factor for 20-30 years. In many markets, however, there are a limited number of O&M providers capable of providing reliable service, thus undermining the stability of promised cash flows, which means a weaker bond rating. Given the common interest among developers in ensuring a robust supply of O&M services, the industry should consider ways to ensure an active marketplace of O&M providers.

DEVELOP detailed databases of customer default rates

As noted above, cash flows from bonds depend on ability to receive PPA payments from customers—which, in the case of rooftop solar projects, are often individual households or businesses. There are weak linkages, however, between the length of PPAs (often 20 years) and historical data on the rooftop solar industry (which has only achieved significant scale the past few years).[122] Lack of data on customer default rates creates a significant barrier to such bonds securing investment grade ratings. Particularly in the case of rooftop solar, the industry should be actively collaborating with financiers, loan service providers and rating agencies to build customer payment datasets that can be used to satisfy the demand for more historic data. Standard & Poor's recent preliminary approval of SolarCity bonds is an important step in this regard.

USE CREDIT ENHANCEMENT to develop a track record for securitized clean energy bonds

To jump-start the market for clean energy project bonds while the above issues are being resolved, banks should also be using their balance sheets to help develop a performance track record for bonds linked to clean energy projects. For example, banks could provide loans to portfolios of wind and solar projects and aggregate these loans into asset-backed securities. To assure an investment-grade credit rating, banks could use a small portion of their balance sheets to provide "credit enhancement" to the securities.[123] Potential credit enhancement mechanisms include a "loan loss reserve fund" (to cover a first portion of losses on the securities) or, where existing legislation allows, use of covered bonds. Moving more clean energy project securities into the marketplace and to the attention of actual investors is critical for accelerating this market while creating new business for the banks themselves.

121 NREL Solar Securitization and Public Capital Finance, "Update: SAPC Standard Contracts Now Available," March 21, 2013. https://financere.nrel.gov/finance/solar_securitization_public_capital_finance

122 Standard & Poor's, "Will Securitization Help to Fuel the U.S. Solar Power Industry?," January 23, 2012, 3.

123 As discussed in Recommendation 5 above, this would complement "credit enhancement" efforts underway in the public sector.

ROLE for Investors

- ✓ Investors can promote asset-backed clean energy securities in multiple ways:
- ✓ Communicate their interest and demand for such products and help develop them
- ✓ Engage in venues such as the National Renewable Energy Laboratory (NREL)'s Solar Access to Public Capital forum to express what investors need to invest in such projects

IMPACT on Risk and Return of Clean Energy Investments

Asset-backed securities for energy efficiency and renewable energy projects offer long-term, low-volatility yields that match well with the liabilities of insurers and pension funds (and hence offer a potentially attractive risk-return profile). To reach a scale that is attractive to these investors, however, this market must overcome the growing pains common to any new capital markets product. The initiatives outlined in this recommendation will (1) minimize the due diligence burden on buyers of clean energy ABS issues (by standardizing PPA terms); (2) make future cash flows from such issues more stable (by strengthening the supply of O&M providers to keep systems in service); (3) enable more accurate rating and pricing of such issues (via more detailed historical data); and (4) limit downside risk for buyers of early clean energy ABS issues (via credit enhancement from banks). For investors participating in such initiatives will be a down payment on the extra-yield they can reap in the future.

Promote

RECOMMENDATION 7

Encourage development bank finance and technical assistance for emerging economies

- **Expand "North-South" financing of clean energy to $100 billion per year by 2020**
- **Provide risk insurance for clean energy, possibly through the Green Climate Fund**
- **Develop broad public-private partnerships to provide technical expertise in transition planning, power, buildings and transport**

Developing economies' share of global clean energy investment is large and growing rapidly. In 2012, developing (i.e. non-OECD) economies accounted for 35 percent of global clean energy investment ($98 billion).[124] Moreover, of the $740 billion per year in projected global investment in the electric power sector through 2035, developing economies account for more than 60 percent of total investment.[125] Given that the majority of the clean energy investment needed for a 2 °C future will occur in emerging economies, there is much that policymakers can do in terms of direct finance, investment-related policies, and technical assistance to facilitate and expand such investments. Note that institutional investors are a key source of funds for many of the entities (e.g. multilateral development banks) best positioned to strengthen frameworks for clean energy investment in developing countries; as such, investors institutional investors have ample opportunities to champion the recommendations of this section.

EXPAND "North-South" financing of clean energy with the goal of $100 billion per year by 2020

As part of the 2010 Cancun Agreements, developed countries pledged to increase funding for climate change mitigation and adaption in developing countries to $100 billion per year by 2020 from a mix of public and private sources.[126] Assuming (conservatively) that one-third of this amount will be allocated to mitigation in the form of clean energy deployment, this suggests that annual "North-South" flows of clean energy investment must rise from a 2012 level of $10.2 billion[127] to a 2020 level of roughly $100 billion. Since development banks—chiefly the World Bank, Asian Development Bank, European Investment Bank, Inter-American Development Bank and Agence Francaise de Developpement—are currently the source of 97 percent of this "North-South" investment,[128] they will have to play the lead role in scaling up these capital flows.[129] As the World Bank and others phase out support for coal-fired generation in developing countries[130]—a policy that all development banks ought to follow—they should repurpose these resources to support renewable energy and energy efficiency. *Given the significant leverage that can be achieved using public funds to support investment in developing countries—between $3-15 of private investment for every $1 of public funds deployed[131]—even small increases in development bank financing will yield valuable impacts.*

124 BNEF, *Global Trends in Clean Energy Investment*, 31.

125 IEA, *World Energy Outlook 2013*, 192. The $740 billion per year figure is in constant 2012 dollars.

126 UNFCC Cancun Agreements, "New Long-Term Funding Agreements," http://cancun.unfccc.int/financial-technology-and-capacity-building-support/new-long-term-funding-arrangements/, accessed December 23, 2013. Since formalizing the Cancun Agreements, developed countries have fulfilled a "fast start finance" commitment to provide more than $30 billion in new and additional public resources for climate action. US State Department, "Strategies and approaches for scaling up long-term finance," October 7, 2013, http://unfccc.int/files/documentation/submissions_from_parties/application/pdf/cop_suf_usa_07102013.pdf

127 BNEF, *Global Trends in Clean Energy Investment*, 31. In 2012 this $10.2 billion amounted to 26 percent of total cross-border renewable energy asset finance.

128 BNEF, "Development Banks—breaking the $100bn-a-year barrier," 6.

129 This is particularly true as the Green Climate Fund (GCF)—a new multilateral institution intended to help fulfill the Cancun commitments—is (understandably) taking time to capitalize and begin investing.

130 http://www.worldbank.org/en/news/feature/2013/07/16/world-bank-group-direction-for-energy-sector

131 UNEP (2008), *Public Finance Mechanisms to Mobilise Investment in Climate Change Mitigation* (UNEP, Nairobi).

Fortunately, promising opportunities abound to scale up development bank support for renewable energy in emerging economies. For example, as part of the GET Feed-in Tariff (GET FiT) Program for East African nations (proposed by Deutsche Bank and taken up by KfW), the World Bank is offering partial risk guarantees to support commercial project financing for up to 15 small-scale (1-20 megawatt) renewable energy projects throughout Uganda that will benefit from the country's feed-in tariff system.[132] The GET FiT model—targeted incentives for small-scale renewable energy, in combination with development bank risk guarantees and private sector financing—represents one way to accelerate renewable energy investment that developments banks should explore replicating elsewhere in Africa and beyond.

PROVIDE effective risk insurance for clean energy—possibly through the Green Climate Fund

From feed-in tariffs in Africa to reverse auctions in India, government policies play a key role in supporting clean energy investment in developing countries. Reliance on policy, however, creates additional risk for investors—something that investors in clean energy in developed countries have learned all too well, such as in 2010 when Spain retroactively cut feed-in tariff payments to solar PV systems. The sometimes opaque and fragmented nature of energy policymaking in many developed countries exacerbates this risk.

Project developers can mitigate this risk if they have the opportunity to purchase political risk insurance that compensates investors from unforeseen adverse changes in government policy. The U.S. Overseas Private Investment Corporation (OPIC), for example, recently provided political risk insurance to a small-scale solar PV project in South Asia to protect the developer against "a variety of risks including government default on an arbitration award and government interference with the dispute resolution process provided under the long-term power purchase agreement." Expanded clean energy deployment in developing countries also increases the need for expanded political risk insurance policies from OPIC, the World Bank and other institutions. The Climate Policy Initiative notes that *effective* policy risk insurance instruments should "(1) streamline and systematically define risks and conditions for coverage; (2) be backed with strong enforcement power from the insurance provider; (3) include developed markets and smaller projects; (4) reduce transaction costs implied by currently available instruments, and (5) improve project creditworthiness.[133]

Widely available political risk insurance for clean energy projects in developing countries, across all clean energy sectors, will be an effective way to leverage public funds to facilitate private investment. For example, political risk insurance could be a key product of the new UN-sponsored Green Climate Fund (GCF), and is something that investors ought to urge the GCF to consider. [134]

DEVELOP BROAD PUBLIC-PRIVATE PARTNERSHIPS to provide technical expertise in transition planning, power, buildings, and transport

To realize the full potential for clean energy investment in developing economies, there is also a need for provision of technical expertise in transition planning, socio-economic policy, and the electric power, building efficiency and transport sectors. Like developed economies, for example, power systems in developing countries are being impacted by trends such as growth of distributed generation and demand response, tangible opportunities for end-use efficiency and electrification of the transportation sector. This creates a pressing need for comprehensive power system policy frameworks to address such inter-related issues as operations, transmission and market design.

132 GetFit Uganda, "Instruments," http://www.getfit-uganda.org/about-get-fit/instruments/, accessed December 23, 2013.

133 CPI, *Policy Gaps: Policy Risk Instruments*, January 2013, http://climatepolicyinitiative.org/wp-content/uploads/2013/01/Risk-Gaps-Policy-Risk-Instruments.pdf.

134 Sierra, Katherine. "The green climate fund: Options for mobilizing the private sector." (2011).

Meeting this need requires continuing and expanding multilateral efforts such as the Clean Energy Ministerial 21st Century Power Partnership (21CPP),[135] "a platform for international efforts to advance integrated policy, regulatory, financial, and technical solutions for the deployment of renewable energy in combination with large-scale energy efficiency and smart grid solutions." 21CPP is leveraging the technical and regulatory expertise of its members—such as the U.S. National Renewable Energy Laboratory and ENTSO-E, the European grid operator—to provide tools and processes for developing country power systems in areas such as smart grids and intelligent demand. Current 21CPP projects include consultations on large-scale grid integration of solar PV in China and state-level policy approaches to energy efficiency in South Africa. In combination with other public-private partnerships such as the International Labor Organization's work on green jobs and sustainable development,[136] the UN Sustainable Energy for All initiative, the World Bank's Renewable Energy Toolkit, the IEA Electricity Coordination Group, and the Global Green Growth Forum, efforts such as the 21CPP will be essential to meet the goal of "rapidly accelerating energy access in emerging economies, while simultaneously de-carbonizing power systems globally."

☑ ROLE for Investors

Investors can promote the above initiatives in the following ways:

- ✓ As holders of the debt of development banks, encourage these institutions to devote more funds to clean energy financing and communicate the benefits to project developers from expanded political risk insurance

IMPACT on Risk and Return of Clean Energy Investments

By reducing sovereign risk, expanded risk insurance for clean energy investments in developing countries removes a key red flag on otherwise attractive investments. More generally, one the knock-on effects from helping emerging economies to embrace a low-carbon future is that such economies are (particularly in the case of the power sector) more likely to open new investment opportunities to outside sources of capital (note that development bank financing creates $3-15 of private investment opportunity for every $1 of public funds deployed).

135 Clean Energy Ministerial, "Power System Transformation in Emerging Economies," April 17, 2013, http://www.cleanenergyministerial.org/Portals/2/pdfs/CEM4 percent20Portal percent20Docs/Background percent20PPT percent20- percent20PowerSystemTransformation.pdf

136 ILO, "The ILO's Green Jobs Programme," May 22, 2013, http://www.ilo.org/global/topics/green-jobs/projects/WCMS_213842/lang—en/index.htm.

RECOMMENDATION 8

Support regulatory reform to utility business models to accelerate deployment of clean energy sources and technologies

- **Utilities role as developer of clean energy projects**
  - **Finance and develop utility-scale renewable energy projects**
  - **Consider utility ownership of distributed generation**
  - **Invest in carbon capture and storage (CCS)**
- **Utilities role in deploying energy efficiency**
  - **Set ambitious goals for energy efficiency savings (>1% of total electricity sales)**
  - **Enact regulatory changes to promote sufficient investment in energy efficiency**
- **Utilities as integrator of variable renewable energy resources**
  - **Prioritize smart grid investments that improve economics of renewable energy**

The IEA's 2 °C scenario estimates a need to invest $650 billion in the electric power sector annually through 2020 (27 percent of total required clean energy investment). Simply put, the actions of electric utilities and independent power producers will play a central role in determining whether the world moves onto a 2 °C pathway.[137] The actions of utilities will affect new clean energy investment in several ways. First, utilities are a key source of capital for new clean energy investment. In 2012 utility balance sheets supported roughly $90 billion of asset finance for new clean energy projects—60 percent of total asset finance, or about 30 percent of total clean energy investment.[138] Second, electric utilities have tremendous opportunities to promote more efficient consumption of electricity, but to do so must have financial incentives that reward successful energy efficient programs (or, at least, do not actively discourage them). Third, by virtue of their role as grid operator, utilities' ability to cost-effectively integrate increasing amounts of variable renewable resources depends to some extent on their investments to make the grid more intelligent and capable of storing energy.

Accelerating utility investment in clean energy, however, will also require modernizing frameworks for utility regulation. At a high level, this means transforming electric utilities from centralized (primarily fossil-fueled) entities with an incentive to sell ever-greater amounts of electricity to customers to energy-service providers who draw from a range of both centralized and distributed energy resources (e.g. distributed generation, energy efficiency, demand response). In practice, this means that policies such as net metering or feed-in tariffs, decoupling, and measures that explicitly reward distributed resources for the net economic, environmental and reliability benefits that they provide to the grid will play a critical role in accelerating clean energy investment.

Given this multi-dimensional relationship between utilities and clean energy investment, increasing utility investment in clean energy must address the multiple roles that utilities can play (as well as the regulatory structures necessary to support each role).

UTILITIES' ROLE as developer of clean energy projects

Expand investment where possible

Utilities and independent power producers use their balance sheets to fund billions of dollars of investment in wind, solar and other renewable generation projects. Where possible, such investments should be continued and increased. For example, MidAmerican Energy, a subsidiary of Berkshire Hathaway, the

137 Throughout this document the term "electric utilities" is meant to be inclusive of independent power producers.

138 Angus McCrone, "Clean Energy: Green Shoots of Institutional Investment," 2.

conglomerate run by Warren Buffett, has over the last two years invested $5.4 billion in three large U.S. solar projects (with a cumulative capacity of 1,400 megawatts.[139] Other utilities with strong credit ratings have the potential to undertake similar investments, and ought to make doing so a top priority.

Introduce new financing structures where needed

Many U.S. utilities and independent power producers have the capital and credit rating to expand investments in clean energy, but in other markets utility balance sheets are under more duress. Whereas in 2001 all of Europe's top 10 utilities had a credit rating of A or higher, in 2012 only one did.[140] Utilities with strained balance sheets need new structures to finance additional renewable energy investment. The key is to create new financing vehicles that connect utilities (which have expertise in developing and operating renewable energy projects) with pension funds and other institutional investors that have the capital to fund such projects. Utilities can do this in several ways:

- ***New "captive" funds:*** Utilities might create their own "captive" capital funds to attract investment from third-party institutional entities; they would then use these funds to develop and operate portfolios of renewable energy assets, with cash flows returning to the investors.
- ***Sell-Operate:*** After developing renewable energy projects, utilities could unload these from their balance sheets by selling them to pension funds but retain responsibility for operational asset management.[141] This is similar to the YieldCo model described earlier in this paper.[142]

As noted above, a key will be aggregating renewable energy assets to a scale that is attractive to institutional investors.

Consider ownership of large-scale configurations of distributed generation

By eroding the rate base of utilities, deployment of customer-owned distributed generation (such as rooftop solar PV) will over time pose financial challenges for many utilities. Aversion to such financial impacts had led some utilities to emphasize the costs that distributed generation can impose on the power grid, in terms of both lost revenue and the need for additional back-up capacity to balance intermittency. Distributed generation, however, can also benefit utilities by reducing congestion, deferring the need for transmission and distribution upgrades and reducing line losses; these monetary benefits are in addition to societal benefits such as reduced air pollution and local job creation.[143]

Given the benefits of distributed resources and evidence that utility ownership of distributed generation leads to greater deployment,[144] utilities should explore ownership of portfolios of distributed generation. In markets where utilities are barred from owning generation capacity, regulatory changes may be needed to enable this development. Where direct ownership is not possible, utilities should find other ways to support investment in distributed generation.

Extend investment to carbon capture and storage (CCS)

A second key initiative for electric power companies is to ramp up investment in deployment of carbon capture and storage (CCS) technology for power plants. In fact, the IEA projects a need for $7 billion of CCS investment through 2020.[145] Achieving this 2 °C pathway requires increasing the number of operational CCS projects (across all sectors) to around 130 by 2020. Currently, however, only two

139 Travis Hoium, "What Value Does Warren Buffett See in Solar," *Daily Finance*, April 17, 2013, http://www.dailyfinance.com/2013/04/17/what-value-does-warren-buffett-see-in-solar/

140 Ben Warren, "Renewable Views," Ernst & Young, December 2012, http://www.ey.com/Publication/vwLUAssets/Renewable_views/$FILE/Renewable_views.pdf

141 Ben Warren, "Renewable Views."

142 Rocky Mountain Institute, "A Rock that Churns out Cash: Solar YieldCos," July 17, 2013, http://blog.rmi.org/blog_2013_07_17_a_rock_that_churns_out_cash_solar_yieldcos

143 Travis Bradford and Anne Hoskins, "Valuing Distributed Energy: Economic and Regulatory Challenges Working paper for Princeton Roundtable," April 26, 2013 http://travisbradford.files.wordpress.com/2012/01/de-whitepaper-final-0426.pdf

144 Ceres, "The 21st Century Electric Utility: Positioning for a Low-Carbon Future," July 2010, https://www.ceres.org/resources/reports/the-21st-century-electric-utility-positioning-for-a-low-carbon-future-1

145 IEA, *Energy Technology Perspectives 2012*, 142.

large-scale power generation projects with CCS are being constructed around the world, with another 40 in the planning stages.[146] Even against the backdrop of ambiguous national climate policies, utilities should prioritize finding ways to bring commercial-scale projects to realization, as opposed to the recent trend of projects being cancelled. Given the current costs of this technology, governments should support its further development and deployment. CCS is necessary to allow continued global coal combustion for power generation without causing potentially catastrophic climate change, and commercial-scale deployment is necessary to develop the technology and bring down its costs.[147]

UTILITIES' ROLE in deploying energy efficiency

Ambitious targets for energy efficiency savings

Energy efficiency should be the "first fuel" of choice for electric utilities. Consistent with results achieved by leading utility energy efficiency programs in the U.S., regulators and utilities should agree to pursue all cost-effective energy efficiency and set a target for annual savings equal to at least 1 percent of total annual electricity use.[148] Such a target reflects the level of savings in leading utility energy efficiency programs and also the crucial role of energy efficiency in least-cost emissions-reduction pathways.[149] In the U.S. electric utilities deploy almost $7 billion annually into energy efficiency programs, a figure that could double by 2020. Aside from setting ambitious savings targets (which, research has found, typically lower the average cost of each kilowatt-hour saved[150]), utilities should also fully include energy efficiency in electric system resource planning.

Regulatory changes to ensure adequate energy efficiency investment

Targets for energy efficiency are of little use, however, without a regulatory environment that encourages utilities to pursue such activity. Key regulations needed to ensure adequate investment toward meeting energy efficiency targets include:

- ***Lost margin recovery (i.e. "decoupling"):*** The traditional link between electricity sales and utility revenues—more electricity sold means more revenue—gives utilities a financial disincentive to support energy efficiency measures that reduce electricity use. Decoupling ensures that a utility recovers its commission-approved rate of return regardless of sales fluctuations, thereby severing the link between power sales and profits.[151] This allows utilities to both pursue large-scale energy efficiency (or distributed generation) programs without threatening profitability and support public policies (such as building codes) required to realize growth in these areas.[152] Despite its significant benefits, decoupling is still far from the norm for electric utilities. In the U.S., less than half of states currently have (or are considering) some form of decoupling.[153] Given the importance of enabling financially healthy utilities to co-exist with robust energy efficiency programs, utilities and regulators should prioritize decoupling as a key component of 21st century electricity regulation. Investors, corporate customers and NGOs should actively support the necessary legislation and regulatory reforms.
- ***Program cost recovery:*** Utilities must be able to recover upfront, fixed costs of administering energy efficiency programs.
- ***Performance incentives:*** Utilities should be rewarded for exceeding program goals and penalized for failing to meet them.

146 Global CCS Institute, The Global Status of CCS: Update, January 2013, January 31, 2013, http://www.globalccsinstitute.com/publications/global-status-ccs-update-january-2013

147 To the extent that utilities wish also to invest in CCS projects for industry—e.g. at cement production or natural-gas processing facilities—such investments would also be a positive development.

148 American Council for an Energy Efficient Economy, "The State Energy Efficiency Scorecard," http://aceee.org/state-policy/scorecard, accessed December 23, 2013.

149 IEA, World Energy Outlook 2013, 81.

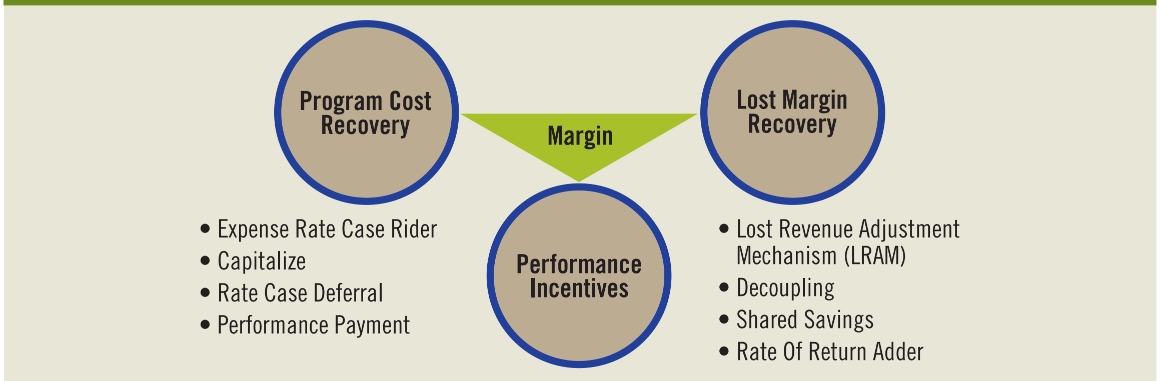
150 Tom Eckman, Northwest Power and Conservation Council, BPA Utility Energy Efficiency Summit, March 17, 2010, and Navigant Consulting analysis.

151 Ceres, "The 21st Century Electric Utility: Positioning for a Low-Carbon Future," 32.

152 Note, however, that decoupling does not create a financial incentive for utilities to support energy efficiency and distributed generation—in only removes the disincentive to do so.

153 Ceres, "Practicing Risk-Aware Electricity Regulation: What Every State Regulator Needs to Know," April 2012, http://www.ceres.org/resources/reports/practicing-risk-aware-electricity-regulation/view

FIGURE 14: ELEMENTS FOR INCENTIVIZING EE FOR INVESTOR OWNED UTILITIES



Source: National Action Plan for Energy Efficiency, November 2007

UTILITIES AS INTEGRATORS of variable renewable energy resources

Prioritize smart grid investments to improve the economics of renewable energy

Energy generated from a wind turbine or solar PV farm is variable—it fluctuates over the course of the day (and year) and cannot be dispatched as needed. The capabilities of existing power grids, however, often limit the amount of variable energy resources that can be integrated without compromising reliability or raising cost excessively. As a result, utilities often must curtail the power output from renewable generators, wasting a low-cost energy resource and harming project economics.[154]

Fortunately, smart grid technology—such as advanced sensors, communications infrastructure, energy storage and control systems—offer the potential to improve this situation.[155] Utilities should prioritize smart grid investments that enable more integration of renewable energy technologies, and seek regulatory support for these improvements. A study by Navigant Consulting estimated that by 2020, smart grid functionality could help increase the penetration of distributed solar PV by more than 60 percent over the reference case with a conventional grid.[156] Another recent study by the U.S. National Renewable Energy Laboratory concluded that, given adequate deployment of smart grid technologies, "renewable energy resources accessed with commercially available generation technologies, could adequately supply 80 percent of total U.S. electricity generation in 2050 while balancing supply and demand at the hourly level."[157] Similar conclusions have been reached for Europe and other markets.[158]

When allocating their capital investment dollars, utilities should emphasize investments that improve the economics and deployment of variable renewable energy resources.

Utilities should embrace the shift from a centralized, fossil fuel based electricity system to a model where utilities become energy service providers integrating both centralized generation, distributed generation and demand-side resources. Regulators also have a responsibility to encourage such decisions. The California Public Utilities Commission (CPUC), for example, recently approved a target for the state's three investor-owned utilities to procure a total of 1,325 MW of energy storage by 2020 (an amount equal to 1 percent of annual peak loads in 2020).[159] Other states and regions should consider replicating this mandate as a way to expand solar, wind and other variable energy resources.

154 Diane Cardwell, "Intermittent Nature of Green Power is Challenge for Utilities," *New York Times*, August 14, 2013, http://www.nytimes.com/2013/08/15/business/energy-environment/intermittent-nature-of-green-power-is-challenge-for-utilities.html?_r=0

155 Key components of the Smart Grid as it is currently being implemented include Advanced Metering Infrastructure (AMI), Distribution Automation (DA), synchrophasor measurement and grid visualization, and the integration of distributed energy resources (DERs), including renewable energy and energy storage.

156 Navigant Consulting, "PV Market Penetration Model and Low PV System Pricing," 2010.

157 Mai, T.; Sandor, D.; Wiser, R.; Schneider, T, *Renewable Electricity Futures Study: Executive Summary*, NREL/TP 6A20 52409-ES. Golden, CO: National Renewable Energy Laboratory, 2012, 3, http://www.nrel.gov/docs/fy13osti/52409-ES.pdf

158 European Climate Foundation, *Roadmap 2050: Practical Guide to a Prosperous, Low-Carbon Europe*, April 2010, http://www.roadmap2050.eu/attachments/files/Volume1_fullreport_PressPack.pdf

159 California Public Utilities Commission press release, "CPUC Sets Energy Storage Goals For Utilities," October 17, 2013, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M079/K171/79171502.PDF

☑ ROLE for Investors

Investors can support adoption of pro-clean energy business models by electric utilities via:

- ✓ ***Engagement with companies:*** Engaging with utility companies to encourage greater deployment of renewable energy and investment in energy efficiency. Investors should query utilities on what they are doing in the areas of clean energy generation and capacity, advanced infrastructure, distributed energy resources, and energy efficiency—benchmarking activity against what other leading companies are doing. For companies with healthy balance sheets (i.e., most U.S. utilities), the goal should be to convince utilities to devote more of their balance sheets to these areas. For utilities with weakening balance sheets (e.g. many in Europe), the focus should be on creating new financial structures for institutional investment in utility-operated clean energy projects.
- ✓ ***Get involved in regulatory proceedings:*** As regulated entities, rate cases of public utility commissions are hugely important in determining how utilities operate. Shareholder interests already loom over such proceedings, with the "need to perform for shareholders" frequently invoked by utilities to justify a particular course of action. As major shareholders, institutional investors should more actively engage in such proceedings to emphasize the role of clean energy in creating more sustainable utility business models. On issues such as permitting utility ownership of distributed generation, allowing reimbursement of up-front expenses for energy efficiency programs and decoupling, investors should make clear to regulators the long-term benefits of such changes. As involvement in such proceedings can be costly and time-consuming, institutional investors should consider ways to collaborate—both among themselves and with clean energy advocacy groups—to enable broader participation.

IMPACT on Risk and Return of Clean Energy Investments

With a combined enterprise value of trillions of dollars, relatively low volatility and predictable earnings, the debt and equity of electric utilities has long held a significant share of institutional investor portfolios. Many trends, however, are eroding the viability of traditional utility business models. As with any industry that receives trillions of dollars of institutional investment, investors have a strong interest in ensuring that electric utilities remain viable investments. Helping utilities to adopt new, more sustainable business models will preserve the electric utility sector as a viable place for investors to put investment capital to work.

RECOMMENDATION 9

Support policies that result in a strong price on carbon pollution from fossil fuels and phase out fossil fuel subsidies

- **Carbon prices (whether via carbon tax or cap-and-trade program) should be at least $20-$50 per ton of carbon-dioxide equivalent (tCO_2e) emitted**
- **Expand existing and new programs to cover 50 percent of global CO_2 emissions**
- **Encourage businesses to adopt internal (“shadow”) carbon prices**
- **Where needed, complement carbon prices with sector-specific mandates**
- **Maximize effectiveness of carbon prices by phasing out subsidies to fossil fuels**
- **Promote clear communication on the costs of fossil fuel use and provide transitional assistance to groups affected by carbon prices and removal of fossil fuel subsidies**

Currently the economics of clean energy are disadvantaged due by a profound market failure—the costs of carbon pollution (in terms of societal damages from current and future global warming) are not reflected in the *price* of fossil fuels. Ignoring this cost makes fossil fuel energy appear less costly than it really is, and tilts the scales against energy efficiency and clean energy sources. Private-sector efforts will not and cannot be effective absent a strong and consistent policy framework provided by government—the economics of the existing market failures are too strong. Policymakers should correct this market failure by making fossil fuel energy prices reflect the full cost of carbon pollution. The best way to do this is through low-carbon policies that lead to economy-wide carbon prices, supplemented where necessary by sector-specific, technology-neutral mandates such as a low-carbon fuel standard. Investor, company and utility support for smart climate and energy policies is essential to making this happen and mitigating the risks of climate change.

CARBON PRICE (via tax or cap-and-trade) should be $20-$50 per ton of (tCO_2e)

Two key questions relating to a design of a carbon price are (1) how high a price?; and (2) in what form? With respect to price level, the short answer is high enough to create a pathway to reducing energy-related CO_2 emissions by more than half in 2050 (compared with 2009 levels) and ensuring that they continue to fall thereafter in line with the IEA’s 2 °C scenario. Specific carbon prices will vary by region and will be influenced by wide-ranging factors, including the presence of voluntary or mandatory energy efficiency or renewable energy targets and the broader credibility that the private sector attributes to carbon prices. Both macroeconomic models and technology-specific analyses, however, suggest that prices in the $20-50/ton of carbon-dioxide equivalent (tCO_2e)[160] will make a variety of low-carbon technologies economical and competitive on a global scale.[161]

As for the necessary policy frameworks, a carbon price can take the form of either a carbon tax or a “cap-and-trade” system.[162] If properly designed, both can effectively level the economic playing field between clean and conventional energy sources. Ireland, Sweden, British Columbia and other countries all levy some form of carbon tax—with prices ranging from $3/$tCO_2e$ (in Japan) to $163/$tCO_2e$ (in Sweden).[163] Among cap-and-trade systems, the largest is the European Union’s

160 CO_2e is a measure that describes, for a given variety and quantity of greenhouse gas, the amount of CO_2 that would have made the same contribution to global warming when measured over a specified timescale (usually 100 years). Since different greenhouse gases vary in lifetime as well as in the amount of heat-trapped per unit emitted, CO_2e is a convenient way to compare the global warming potential of different gases.

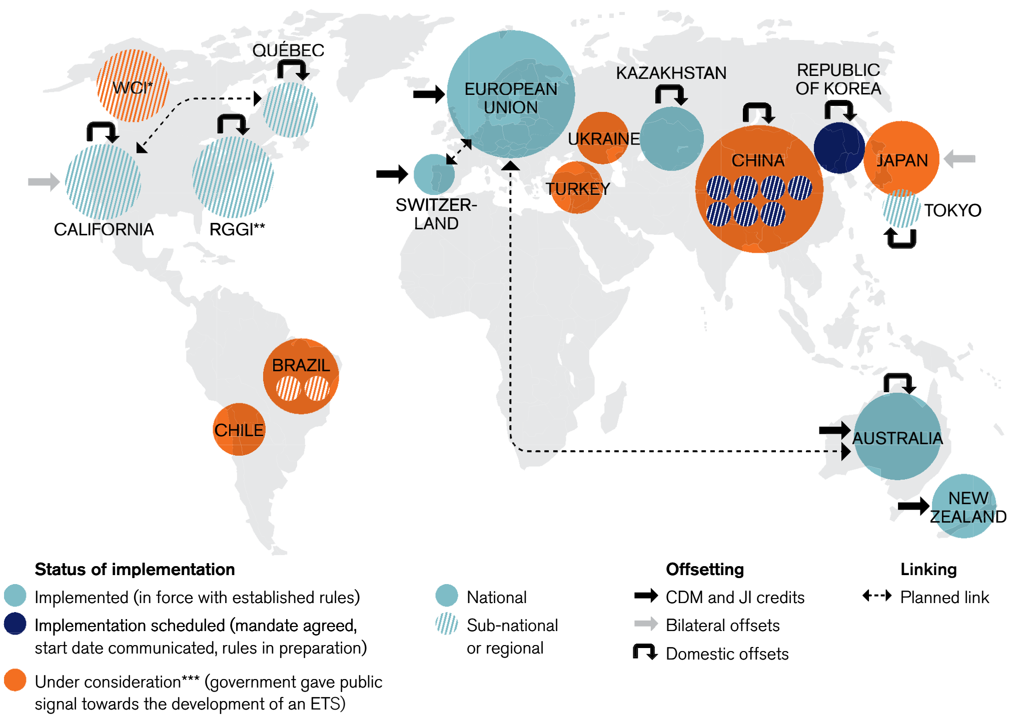
161 Intergovernmental Panel on Climate Change (IPCC), *IPCC Fourth Assessment Report: Climate Change 2007*, “Price levels required for deep mid-century emission reductions: the wider evidence,” 11.6.3, 2007, http://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch11s11-6-3.html

162 For a survey of existing and planned systems, see Carbon Finance at the World Bank, “Mapping Carbon Pricing Initiatives: Developments and Prospects 2013”, May 2013, http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/05/23/000350881_20130523172114/Rendered/PDF/779550WP0Mappi0til050290130morning0.pdf

163 World Bank, “Mapping Carbon Pricing Initiatives: Developments and Prospects 2013”, 55. Elisabeth Rosenthal, “Carbon Taxes Make Ireland Even Greener,” *New York Times*, December 27, 2012, http://www.nytimes.com/2012/12/28/science/earth/in-ireland-carbon-taxes-pay-off.html?_r=0. British Columbia Ministry of Finance, “How the Carbon Tax Works,” http://www.fin.gov.bc.ca/tbs/tp/climate/A1.htm, accessed December 13, 2013.

Emissions Trading System (EU ETS). Launched in 2005, the EU ETS operates in all 28 EU countries (as well as Iceland, Norway and Lichtenstein) and covers 45 percent of the EU's greenhouse gas emissions (i.e. emissions from power and heat generation, energy-intensive manufacturing, and civil aviation).[164] Similar systems exist in California, the Northeastern U.S., and several other countries and sub-national entities—including China, which is currently conducting pilot programs in seven cities.[165] Current carbon trading prices for the largest existing carbon cap-and-trade systems, however, are generally well below the \$20-\$50/tCO_2e range, including California (\$14/tCO_2e), Europe (\$7/tCO_2e), and especially the Northeastern U.S. (\$3/tCO_2e).[166]

FIGURE 15: MAP OF EXISTING, EMERGING, & POTENTIAL EMISSIONS TRADING SCHEMES



Source: World Bank, 2013

** WCI – Western Climate Initiative. Participating jurisdictions are British Columbia, California, Manitoba, Ontario and Québec ** RGGI – Regional Greenhouse Gas Initiative *** Schemes under consideration are at different stages in the process.* ***Note 1:*** *The size of the circles is not representative of the size of the schemes.* ***Note 2:*** *Mexico's Congress passed a General Law on Climate Change, which provides the federal government with the authority to create programs, policies, and actions to mitigate emissions, including an ETS.* ***Note 3:*** *Costa Rica is working on the design of a domestic carbon market that would contribute to meeting the country's carbon neutrality goal.* ***Note 4:*** *Australia's Parliament is currently considering bills to repeal the country's carbon trading regime.*

EXPAND existing and new programs to cover 50 percent of global CO_2 emissions

The World Bank estimates that 40 national and 20 sub-national jurisdictions (across both developed and developing countries)—representing 21 percent of the total of 50 $GtCO_2e$ that are emitted globally each year—already have or are considering implementing explicit carbon pricing.[167] Since these mechanisms usually do not cover all domestic emissions, however, the effective coverage is reduced

164 Now in its "3rd trading period" (2013-2020), the program aims to reduce the EU's greenhouse gas emissions 20 percent by 2020 and 80-95 percent by 2050 (relative to 1990 levels). European Commission, "The EU Emissions Trading System (EU ETS)," http://ec.europa.eu/clima/publications/docs/factsheet_ets_en.pdf, accessed December 23, 2013.

165 Stefanie Tanenhaus, "China Adds Another Tool to Curb Pollution, Launching First Cap and Trade Program," Natural Resources Defense Council staff blog, June 18, 2013, http://switchboard.nrdc.org/blogs/stanenhaus/china_adds_another_tool_to_cur.html

166 Prices cited for December 2013. World Bank, "Mapping Carbon Pricing Initiatives: Developments and Prospects 2013", 82. Thomson Reuters, "Market Data: EU ETS," http://www.pointcarbon.com/news/euets/ accessed December 13, 2013. RGGI Inc., "C02 allowances Sold at \$3.00 at 22nd RGGI Auction," December 6, 2013, http://www.rggi.org/docs/Auctions/22/PR120613_Auction22.pdf. California Air Resources Board, "Cap-and-Trade Program," December 23, 2013, http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm.

167 World Bank, "Mapping Carbon Pricing Initiatives: Developments and Prospects 2013", 12.

to around 7 percent of global emissions. Broadening carbon pricing programs in developed countries and enacting planned initiatives in major emerging economies (such as China, Brazil and others), however, could put an effective carbon price on nearly half of global CO_2 emissions. This scope of carbon pricing, half of global CO_2 emissions, is a target policymakers should seek—and investors should support—to achieve by 2020. And these carbon prices should be high enough to spur new investment in clean energy and reduce emissions in line with a 2 °C future.

ENCOURAGE BUSINESSES to adopt internal ("shadow") carbon prices

In the near future political gridlock will in many countries continue to thwart adoption of an explicit price on carbon. Legislative inaction, however, does not relieve the need for begin preparing for a low-carbon future. Prudent companies are already doing this by implementing a "shadow price" on carbon in their long-term financial plans. CDP recently reported that 29 large companies based or operating in the U.S. across multiple sectors (including Google, Walmart, Exxon Mobil and Walt Disney) are using shadow carbon prices of \$6-60/tCO_2e.[168] CDP notes that such companies use a shadow carbon price as "a planning tool to help identify revenue opportunities, risks, and as an incentive to drive maximum energy efficiencies to reduce costs and guide capital investment decisions." Investors should encourage all companies to adopt shadow carbon prices as a means for properly evaluating the costs and benefits of investments decisions, in particular those related to clean energy.[169]

WHERE NEEDED, complement carbon prices with other sector-specific measures

A given carbon price will spur different levels of clean energy investment across different sectors. In particular, whereas investment in the power sector may respond strongly to a carbon price in the range of \$20-50/tCO_2e, investment in the transport sector will often require much higher carbon prices in order to shift investment away from petroleum-based fuels (which currently supply 95 percent of the world's transportation energy). Simply put, there is a need to complement carbon prices with other measures specifically designed to support deployment of biofuels and advanced vehicles (e.g. plug-in hybrids, electric vehicles and fuel-cell vehicles). One example of such a policy is California's Low-Carbon Fuel Standard (LCFS).[170] The LCFS sets performance standards for the lifecycle carbon intensity of gasoline and alternative fuels, as well a separate standard for diesel and alternative fuels; each standard is intended to lower the carbon intensity of California's statewide transportation mix by an average of 10 percent by 2020. By increasing market demand for clean transport—but allowing such demand to be met by a wide variety of fuels and technologies—policies such as the LCFS (and similar measures enacted by the European Union) are cost-effective ways to accelerate transport-related clean energy investment.

STRENGTHEN POLICY FRAMEWORKS by phasing out government subsidies to fossil fuels

Investors' risk-return calculus should take into account all manner of relevant policies, not just particular measures that policymakers may currently wish to emphasize. Scrutiny should include policies inconsistent with or contrary to the goal of transforming the global energy system to reduce CO_2 pollution. A notable example in this regard is wasteful government subsidies for production and use of oil, natural gas and coal, all of which have major CO_2 footprints. Aside from distorting the

168 CDP, "Use of internal carbon price by companies as incentive and strategic planning tool: A review of findings from CDP 2013 disclosure," December 2013, https://www.cdp.net/CDPResults/companies-carbon-pricing-2013.pdf

169 Note also that some governments have begun adopting a form of shadow carbon price. For example, earlier this year President Obama instructed the EPA to use assume a carbon price of \$37/tCO_2e when evaluating the costs and benefits of proposed regulations. Similar to the case for companies, shadow carbon prices for regulatory analysis ensure proper evaluation of all energy-related investment decisions. Interagency Working Group on Social Cost of Carbon, United States Government, "Technical Update on the Social Cost of Carbon for Regulatory Impact Analysis—Under Executive Order 12866," May 2013, http://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf

170 California Air Resources Board, "Proposed Regulation to Implement the Low Carbon Fuel Standard—Volume 1," March 5, 2009, http://www.arb.ca.gov/regact/2009/lcfs09/lcfsisor1.pdf

economics of clean energy (particularly in the transport sector), such subsidies—particularly in the developing world—amplify carbon pollution (and other pollutants) and drain limited fiscal resources from lower-polluting activity. Including the negative environmental and health impacts of fossil fuels, the International Monetary Fund (IMF) calculated the cost of fossil fuel subsidies in 2011 at $1.9 trillion—2½ percent of global GDP or 8 percent of total government revenues.[171] Following through on commitments such as those made at the Rio+20 conference,[172] policymakers should phase out subsidies to fossil fuels and fossil-fuel electricity.

PROMOTE CLEAR COMMUNICATION on the costs of fossil fuel use and provide transitional assistance to groups affected by carbon prices and removal of fossil fuel subsidies

Examples from multiple countries show that promoting informed debate about the costs of fossil fuel use, planning and executing transitional economic development programs, and integrating carbon price/fossil fuel subsidy measures into broader structural reforms will help improve the transition of pricing carbon pollution from fossil fuels.[173] To achieve public acceptance, policymakers, with investor support, should clearly communicate the rationale and benefits of a carbon price, while also addressing impacts on low-income populations, fossil fuel dependent regions and national competitiveness. Moreover, carbon prices should be phased-in on a trajectory that mitigates negative transitional economic impacts in regions most adversely affected by the transition to cleaner energy.

☑ ROLE for Investors

To promote the above initiatives, investors should emphasize to policymakers the business case for investment in low-carbon energy and the essential role of a carbon price (and other complementary measures such as low-carbon fuels standards) in catalyzing such investments.

IMPACT on Risk and Return of Clean Energy Investments

Climate change has the potential to harm long-term investor returns via (1) actual physical impacts (e.g. heat waves, storms, etc.) that devastate individual companies and slow the growth of entire economies;[174] and (2) implementation of policies to restrict carbon emissions, which, especially if delayed for another decade or so, may come as a drastic and abrupt shock to company business models and economies at large. Adoption of economy-wide carbon prices now *helps* to mitigate both of these risks, and enables investors to plan prudently for the transition to a low-carbon future. More broadly, adoption of carbon prices and removal of fossil fuel subsidies will across all asset classes create tailwinds for low-carbon investments and headwinds for high-carbon investments such as oil and gas production.

171 Clements, Benedict J., David Coady, Stefania Fabrizio, Sanjeev Gupta, Trevor Serge Coleridge Alleyne, and Carlo A. Sdralevich, *Energy Subsidy Reform: Lessons and Implications,* International Monetary Fund, 2013. http://www.imf.org/external/np/pp/eng/2013/012813.pdf. On a "pre-tax basis" (i.e. excluding health and environmental impacts," the IMF report concludes that "subsidies for petroleum products, electricity, natural gas, and coal reached $480 billion in 2011 (0.7 percent of global GDP or 2 percent of total government revenues)." For 2012, the IEA's *2013 World Energy Outlook* calculates fossil fuel subsidies at $544 billion and subsidies to renewable energy at $100 billion.

172 GSI/IISD, "Joint Submission to the UN Conference on Sustainable Development, Rio+20: A pledge to phase-out fossil fuel subsidies," 2011, http://www.uncsd2012.org/content/documents/48Rio20PledgetoReformFossil_FuelSubsidies_FinalSubmission28.10.11.pdf

173 Clements et al., *Energy Subsidy Reform: Lessons and Implications,* 25.

174 Stern, N. Nicholas Herbert, ed. *The Economics of Climate Change: the Stern Review.* Cambridge University Press, 2007.

RECOMMENDATION 10

Support policies to de-risk deployment of clean energy sources and technologies

- **Promote large-scale deployment to reduce technology costs**
- **Ensure that policies are of adequate duration, tied to a technology's level of maturity, never retroactive, and available to the largest possible pool of capital**
- **Seek an eventual transition to an energy policy "level playing field"**

To double annual global investment in clean energy by 2020, investments in clean energy must deliver risk-adjusted returns comparable to the returns available on other investments—especially investments in conventional fossil fuels. Governments can help achieve this by enacting policies that provide transparency, longevity and certainty (TLC) to investors in clean energy.[175] Policymakers should seek to "de-risk" clean energy technologies and accelerate their progress toward cost-competitiveness with conventional energy sources. The end result should be a "level playing field" where large-scale deployment makes clean fuels and technologies cost-competitive with fossil fuels.

For many investors, incentives are cited both as a key driver for further investment and a key risk if they are changed unpredictably. The essential role of incentives for some technologies in some markets notwithstanding, ultimately clean energy sources will scale only as a result of cost-competitiveness with conventional energy sources.

In crafting incentives for clean energy investment, governments should apply the following key criteria:[176]

PROMOTE large-scale deployment to reduce technology costs

Large-scale deployment of clean energy technologies reduces costs by (1) enabling economies of scale that lower manufacturing and installation costs; and (2) creating a performance track record that allows investors to better understand risk-reward profiles, resulting in lower financing costs. Given the virtuous circle of greater deployment, increased investor certainty and lower technology/financing costs, large-scale deployment of clean energy technologies should be a key goal of policymakers. Note that the evolution of Germany's feed-in tariffs for wind, biogas and solar PV suggests *contractual stability* (in the form of standard offer, take-or-pay contracts) rather than a given level of price premium per se, which is key to giving developers and investors the confidence to scale up renewable energy sources.[177] Well-framed electricity market structures, with utility revenues "decoupled" from volume electricity sales, are also essential for large-scale deployment of clean power.

ENACT POLICIES with appropriate time horizons for specific technologies

The lifetime of cash flows from biofuel plants, energy-efficient buildings and other clean energy assets span decades. Investors in these types of assets also require policies aligned with similarly long-term horizons. By enacting short-term policies that make future cash flows unpredictable, thus increasing discount rates that investors apply to those cash flows, policies of inadequate duration create investment uncertainty.

Technologies of different maturity require different types of private financing, and therefore different kinds of policy incentives. A first-of-a-kind biofuels technology seeking venture capital funding for a pilot plant is quite different from a utility-scale wind farm seeking asset finance.[178] Tailoring policies to the maturity levels and financing requirements of specific technologies makes government support more impactful and cost-effective.

175 DB Climate Change Advisors, Global Climate Policy Tracker, April 2012, 31, https://www.db.com/cr/en/docs/Global_Policy_Tracker_20120424.pdf

176 Ceres, Investment-Grade Climate Change Policy: Financing the Transition to the Low-Carbon Economy, September 2011, http://www.ceres.org/files/press-files/2011-global-investor-statement-on-climate-change/investment-grade-climate-change-policy-investment-grade-climate-change-policy

177 DB Climate Change Advisors, German FIT Update 2012, August 2012.

178 World Economic Forum, Green Investing 2010: Policy Mechanisms to Bridge the Financing Gap, January 2010, http://www3.weforum.org/docs/WEF_IV_GreenInvesting_Report_2010.pdf

MATCH THE POLICY to the specifics of geographic markets

Clean energy investment risks are partly a function of high upfront capital costs. In emerging markets—where capital costs are generally higher than in developed countries, and high interest rates and currency volatility pose additional financing challenges—high capital costs can be an especially big hurdle. Policies that provide stable cash flows (such as the GET FiT program described in recommendation 7) are useful in such environments.

PROVIDE CERTAINTY to investors by avoiding retroactive policy changes

By lowering the discount rate that investors apply to cash flows from clean energy projects, increased policy certainty is hugely helpful in bolstering clean energy investment. Nothing undermines certainty, however, as much as retroactive changes in government policy.[179] And since investors tend to have long memories, retroactive changes can undermine clean energy markets not just now but for years to come. Clear criteria and timeframes for changes to government policy (and making such changes exclusively *prospective*) allow for orderly market transitions and, ultimately more cost-effective policy regimes.

USE REVENUE-BASED INCENTIVES (rather than tax-based incentives) to broaden the pool of capital

Effective incentives for clean energy will attract capital from a wide variety of sources. Regrettably, in the U.S. market the key incentives for renewable energy (e.g. the Investment Tax Credit and the Production Tax Credit) are provided via the federal tax code, and are therefore of no use to tax-exempt institutional investors such as endowments and public pension funds. Moreover, even investors with sufficient tax liability must accept significant transaction costs in order to make use of these tax incentives. Rather than complicated tax incentives, an alternative model is to focus on revenue-based incentives such as renewable energy credits, feed-in tariffs and prices on carbon. Moving in this direction would do a great deal to spur more investment in clean energy infrastructure from U.S. pension funds and other tax-exempt entities.

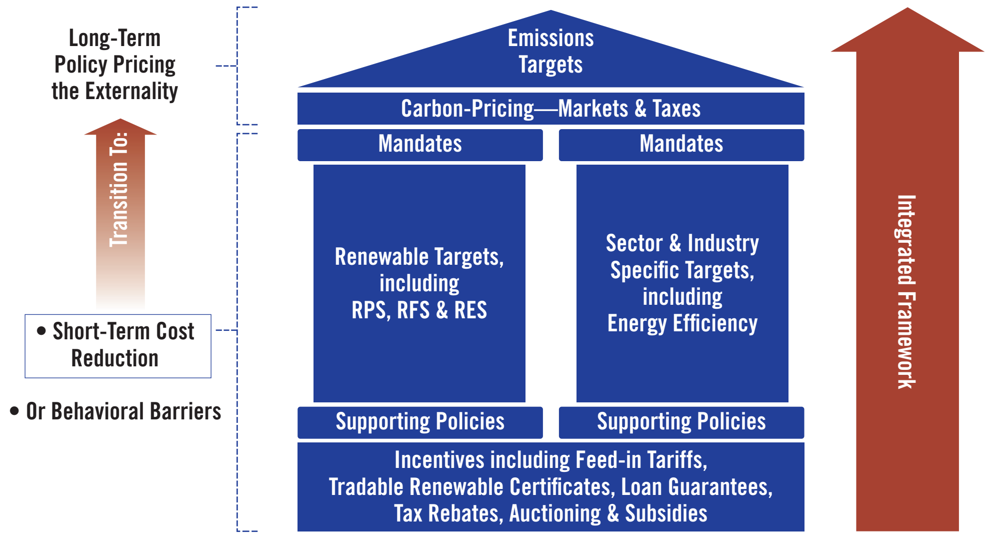
ACHIEVE A "LEVEL PLAYING FIELD" in energy policies

Ultimately, policymakers should pursue integrated frameworks similar to the one illustrated in Figure 16 (next page). In this case, targeted, technology specific incentives (e.g. feed-in tariffs) give way to broader sector-level, technology-neutral mandates and, finally, to a "level playing field" where large-scale deployment makes clean fuels and energy technologies increasingly cost-competitive with fossil fuels. In the end, a carbon price is all the policy support that investors need to continue funding clean energy opportunities.

From the perspective of reducing carbon emissions, it is hugely important to transition away from subsidies and mandates toward technology neutral policies such as low-carbon fuel standards and explicit carbon prices. There are simply too many potential alternatives to subsidize (and too much variance in the costs of those alternatives) to make subsidies for renewable energy and energy efficiency a cost-effective, long-term strategy for reducing carbon pollution. Such policies work best as transitional measures only.

179 One noteworthy example of this being when Spain retroactively reduced feed-in tariff levels for solar PV plants installed between 2009 and 2011. Vladimir Pekic, "Span publishes retroactive PV FIT cuts," *PV Magazine*, February 21, 2013, http://www.pv-magazine.com/news/details/beitrag/spain-publishes-retroactive-pv-fit-cuts_100010298/#axzz2oMZIA083

FIGURE 16: RANGE OF POLICIES AVAILABLE FOR GOVERNMENTS TO PROMOTE CLEAN ENERGY INVESTMENT & REDUCE CARBON EMISSIONS



Source: DB Climate Change Advisers, 2012

☑ ROLE for Investors

Investors can promote the above initiatives in the following ways:

- ✓ Communicate to policymakers how business case for investment in low-carbon energy sources depends on stable and supportive policy frameworks
- ✓ Communicate the key elements of effective frameworks in terms of promoting scale, avoiding retroactivity, and matching incentives to technological maturity

IMPACT on Risk and Return of Clean Energy Investments

Policies that provide stable, long-term cash flows to clean energy projects that do not depend on complicate tax incentives will (perhaps more than anything) compensate for manifold risks of such projects and make them attractive to the institutional investors of all stripes. Moreover, a focus on large-scale deployment will create investment opportunities of the size necessary for investors to justify building expertise in a new area. Finally, inasmuch as deployment lowers the costs of clean energy technologies to be competitive with conventional energy sources, further opportunities for investment will arise that are capable of taking in trillions of dollars of institutional capital.

APPENDIX A

Clean Energy & Jobs

In addition to a safer planet, cleaner air, and trillions of dollars in fuel savings, realizing "Clean Trillion" levels of investment will yield another benefit: millions of new jobs. The daunting complexity of forecasting employment changes for the global economy through 2050, however, makes it difficult to estimate exact job-creation impacts as a result of "Clean Trillion" investments. Previous research on the clean energy-jobs connection does, however, give some insight into how more clean energy investment will expand opportunities for employment.

One notable such effort focuses on the US power sector through 2030, and calculates the job impacts of widespread deployment of renewable energy and energy efficiency (as well as natural gas generation) at the expense of coal-fired generation.[180] Key results from this modeling included:

- *An additional 7.9 million cumulative net job-years*[181] of direct and indirect employment; this job-creation occurs as a result of the "job-years per unit of delivered energy" for energy efficiency and renewable energy being 2-8X as large as for fossil energy sources.
- *486,000 net new jobs* in place in 2030 compared with the start in 2010[182]
- A majority of new jobs created in well-paid existing occupations such as construction, manufacturing, engineering, and related professional services
- Recognition of energy efficiency as the most economical way to create jobs, and solar PV as the energy source that creates the most jobs per unit of delivered energy

Recall that the job-creation numbers above are for a country that has only 5 percent of the world's population. Recognizing this underscores how mobilizing new investment on a "Clean Trillion" scale is likely to create new economic opportunities for hundreds of millions—or billions—of individuals throughout the world.

TABLE 1: CUMULATIVE JOB-YEARS OF EMPLOYMENT, TOTAL DURING 2010-2030

Cumulative Change During 2010-2030	CIM Direct	CIM Indirect	O & M Direct	O & M Indirect	Total Direct	Total Indirect	Sum Total	% Share
Geothermal	56,323	50,690	135,200	121,680	191,523	172,371	363,894	5%
Solar PV	1,251,949	1,126,754	359,332	323,399	1,611,280	1,450,152	3,061,4333	8%
Solar Thermal	25,639	23,075	30,493	27,444	56,131	50,518	106,650	1%
Wind	749,315	674,383	403,669	363,302	1,152,984	1,037,685	2,190,669	28%
Subtotal – RE	2,083,224	1,874,902	928,694	835,825	3,011,919	2,710,727	5,722,645	72%
Natural Gas	82,008	73,807	754,260	678,834	836,268	752,641	1,588,910	20%
Pipelines & Electricity Grid	363,000	326,700	43,052	38,747	406,052	365,447	771,499	10%
Coal , Oil, Coal CCS	40,960	36,864	(578,208)	(520,387)	(537,248)	(483,523)	(1,020,772)	-13%
Nuclear	107,008	96,307	32,911	29,620	139,919	125,927	265,847	3%
EE (Energy Efficiency)	342,806	291,007	NA	NA	342,806	291,007	633,814	8%
Total	**3,019,007**	**2,699,588**	**1,180,710**	**1,062,639**	**4,199,716**	**3,762,226**	**7,961,943**	**100%**

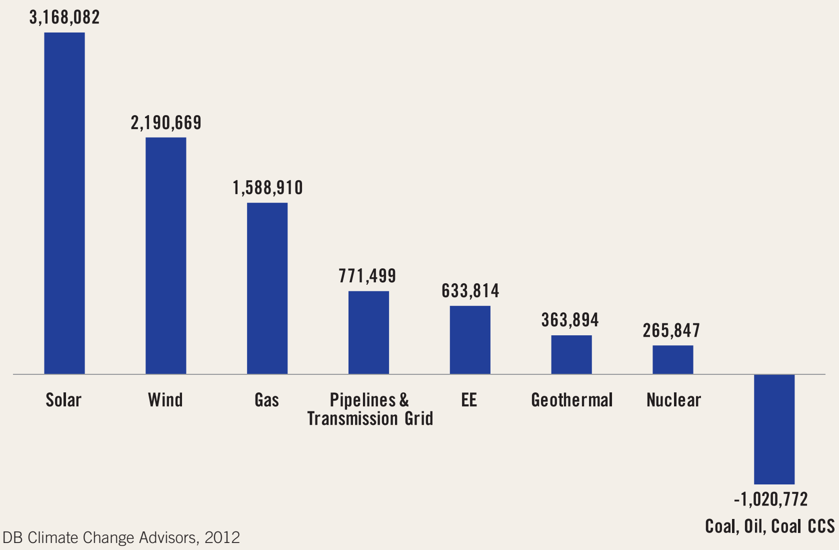
Notes: Data refers to number of job-years: that is years of FTE (full-time equivalent) employment (2,080 hrs work, per job, per year).
The change in employment is using the DBCCA energy forecast during 2010-2030 (cumulative, adding each year's total employment)
CIM (direct): employment directly related to construction, installation or manufacturing. **CIM (indirect):** second-round effects which relate to suppliers who are doing the CIM.
O&M (direct): direct operations and maintenance employment. **O&M (indirect):** second-round employment that relates to those who are doing the O&M work
Source: DB Climate Change Advisors, 2012

180 DB Climate Change Advisors, "Repowering America: Creating Jobs," October 2011, http://www.dbcca.com/dbcca/EN/investment-research/investment_research_2396.jsp. The investments considered include (1) doubling the share of renewable generation (geothermal, hydro, wind, and solar) in the US power supply from 11 percent in 2010 to 24 percent in 2030; (2) significantly increasing power generation from natural gas at the expense of coal; and (3) deploying widespread energy efficiency measures to limit growth in total electricity demand to 0.7 percent per year.181 Such investments would reduce 2030 lifecycle CO_2 emissions by 31 percent relative to a 2005 baseline—generally in line with (if not wholly representative of) a 2 degree C pathway for the US power sector.

181 A job-year of employment is defined as full-time employment for one person during one year (measured by a standard 2,080 hrs of employment/year).

182 The "7.9 million job-years" figure is the cumulative total of all jobs (defined as full-time employment for 1 year) created over the 20-year forecast period, while the "486,000 jobs" figure is an end point or final-year (i.e. 2030) estimate of new full-time employment in place vs. the starting point of the forecast (i.e. 2010).

FIGURE 17: CUMULATIVE JOB-YEARS OF FULL-TIME EMPLOYMENT BY SECTOR—2010-2030



Source: WPK Model, DB Climate Change Advisors, 2012

TABLE 2: SURVEY OF STUDIES ON CLEAN ENERGY & JOB-CREATION

Study	Author	Year	Approach	Forecast	Comment
Geothermal Industry Employment: Survey Results & Analysis	GEA – Cédric Nathanaël Hance for DEA Geothermal Program	2005	Survey of 242 companies (60% response rate)	***34,115 new jobs***	Job-years & Jobs Sector focus: RE Timeframe: snapshot
Green Recovery	PERI / Center for American Progress	2008	IMPLAN input-output model with enhancements	***2 million jobs***	Job-years Sector focus: RE, EE & transport Timeframe: not given
Current and Potential Green Jobs in the U.S. Economy	Global Insight for the U.S. Conference of Mayors and the Mayors Climate Protection Centre	2008	Hybrid combination, using Input-output model, jobs per MW newly installed capacity and 2:1 ratio for indirect employment.	***4.2 million jobs***	Jobs Sector focus: RE, EE & transport Timeframe: 2008-2038
Green Technology & the Green Economy	California Economic Strategy Panel / Collaborative Economics	2008	Uses the National Establishments Time-Series (NETS) database based on Dun & Bradstreet business-unit data to estimate employment at businesses identified as working in the green economy	***43,476 people***	Jobs Sector focus: Timeframe: snapshot
20% Wind by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply	U.S. Department of Energy	2008	Uses the NREL JEDI wind power model	***6.2 million jobs***	Job-years Sector focus: RE Timeframe: 2008-2030
How Infrastructure Investments Support the U.S. Economy: Employment, Productivity and Growth	PERI – Political Economy Research Institute at the University of Massachusetts & AAM	2009	IMPLAN input-output model with enhancements	***11,000 new jobs per $1bn invested in energy related infrastructure***	Jobs Sector focus: energy related infrastructure Timeframe: years
US Green Building Council – Green Jobs Study	Booz Allen Hamilton	2009	IMPLAN input-output model with enhancements	***8 million jobs***	Reads as job-years, but a little ambiguous Sector focus: EE Timeframe: 2009-2013
Green Prosperity	PERI – Political Economy Research Institute at the University of Massachusetts	2009	Minnesota IMPLAN Group (MIG) input-output model with enhancements	***1.7 million net new jobs***	Job-years Sector focus: RE, EE & pollution control Timeframe: not given
Unlocking Energy Efficiency in the U.S. Economy	McKinsey & Co	2009	Cites various author estimates for employment creation, using the BEA input/output model.	***500,000-750,000 jobs***	Jobs Sector focus: EE Timeframe: 2009-2020
The Economic Benefits of Investing in Clean Energy	PERI / Center for American Progress	2009	IMPLAN input-output model with enhancements	***2.5 million new jobs***	Job-years Sector focus: RE Timeframe: 10 years
Job Creation Opportunities in Hydro	Navigant Consulting for the National Hydropower Association (NHA)	2010	BEA input-output analysis with industry data (20 companies)	***1.4 million jobs***	Job-years Sector focus: Hydro Timeframe: 2009-2025
California's Green Economy – Summary of Survey Results	State of California, Economic Development Department	2010	Survey of 43,206 establishments with 35.1% response rate	***432,840 jobs***	Jobs Sector focus: RE & green Timeframe: snapshot
The Solar Year in Review – 2009	SEIA – Solar Energy Industries Association	2010	46,000 jobs		Jobs Sector focus: RE Timeframe: snapshot
Energy Efficiency Services Sector: Workforce Size and Expectations for Growth	Charles Goldman, Merrian C. Fuller & Elizabeth Stuart Lawrence Berkeley National Laboratory	2010	Surveys and data analysis for forecasts	***384,000 job-years by 2020***	Jobs years Sector focus: EE Timeframe: 2008-2020
Shining Bright – Growing Solar Jobs in Iowa	The Iowa Policy Project	2011	Input-output model for Iowa with NREL data on costs	***5,000 new jobs***	Job-years Sector focus: RE Timeframe: 5 years
The Solar & Wind Energy Chain in Michigan	Environmental Law & Policy Center	2011	Industry survey	***4,000 wind and 6,300 solar related jobs***	Jobs Sector focus: RE Timeframe: snapshot
Energy Efficiency Investments as a Economic Productivity Strategy for Texas	John A Laitner, American Council for an Energy Efficient Economy (ACEEE)	2011	Proprietary DEEPER – econometric input-output model plus IMPLAN model datasets for Texas	***100,000 jobs***	Jobs Sector focus: EE Timeframe: 2010-2030
New Jobs – Cleaner Air	CERES / PERI	2011	IMPLAN input-output model with enhancements	***1.5 million new jobs***	Job-years Sector focus: RE & pollution control Timeframe: 5 years
Bio-Energy Industries – California	COECCC – Centre of Excellence – Economic & Workforce Development – California Community Colleges	2011	Survey of 350 companies with 70.1% responding	***3,045 jobs***	Jobs Sector focus: RE Timeframe: snapshot
Appliance and Equipment Efficiency Standards – a money maker and job	AECCC – Gold, Nadel, Laitner & deLaski	2011	Proprietary DEEPER – econometric input-output model using the IMPLAN input-output data set	***40,000 new jobs***	Jobs Sector focus: EE Timeframe: 2009-2030
Sizing the Green Economy – a national and regional green jobs assessment	Metropolitan Policy Project – The Brookings Institute (and Battelle Technology Partnership Practice)	2011	Uses the National Establishments Time-Series (NETS) database based on Dun & Bradstreet business-unit data to estimate employment at businesses identified as working in the green economy	***2,675,545 jobs***	Jobs Sector focus: RE, EE, pollution reduction & conservation Timeframe: snapshot

Source: DB Climate Change Advisors, 2012

APPENDIX B

Defining the Clean Trillion

IEA DEFINITION BASED ON DIFFERENCE IN ANNUAL ENERGY INVESTMENT BETWEEN 6DS AND 2DS

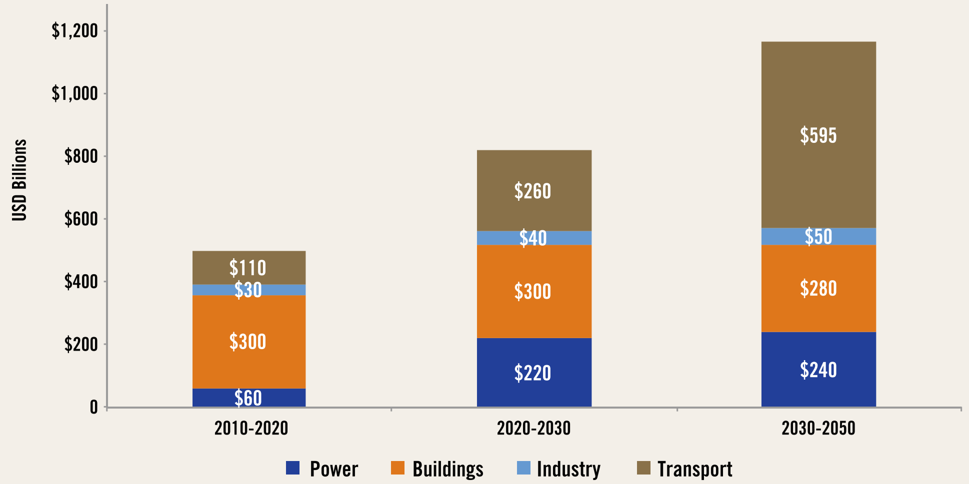
In a scenario where the global average temperature increases to 6 degrees Celsius (6DS) above pre-industrial levels, the IEA forecasts that from 2010-2050 the world will invest $104 trillion in the energy sector (or $2.6 trillion annually).[183] To secure an 80 percent chance of limiting average global temperature increase to 2°C (2DS), total energy investment over this period must increase to $140 trillion ($3.5 trillion annually). This difference in annual energy investment (i.e. $3.5 trillion - $2.6 trillion) between a 2DS and 6DS world (1) amounts to roughly $1 trillion of additional annual investment from 2010-2050; and (2) goes entirely toward clean energy technologies. As a result, we refer to this additional $1 trillion per year in clean energy investment as the "Clean Trillion."

The low-carbon energy sources included in the "Clean Trillion" include:

- ***Power:*** Wind, solar, CCS, other renewables
- ***Transport:*** Hybrid vehicles, plug-in and electric vehicles, fuel-cell vehicles, liquefied petroleum gas/compressed natural gas (slight increase), plane/ship/rail
- ***Buildings:*** water heating, space heating, cooling and ventilation, lighting, appliances and other equipment, building shell improvements
- ***Industry:*** Investment requirements in industrial production plants for the five most energy-intensive sectors (chemicals and petrochemicals, iron and steel, pulp and paper, cement and aluminum). These investments go toward, among other things, more energy efficient equipment, improved energy management, additional recycling, fuel switching and CCS to capture process emissions.

Figure 18 illustrates incremental annual investment in these technologies in a 2DS world, relative to what the IEA predicts will be invested in a 6DS world. Note that moving from a 6 degree pathway to a 2 degree pathway requires an additional $500 billion of annual investment in clean energy through 2020, with additional annual investment rising to $1 trillion by 2030.

FIGURE 18: ADDITIONAL ANNUAL INVESTMENT IN CLEAN ENERGY IN IEA 2 DEGREE SCENARIO RELATIVE TO 6 DEGREE SCENARIO, 2010-2050 ($BN)

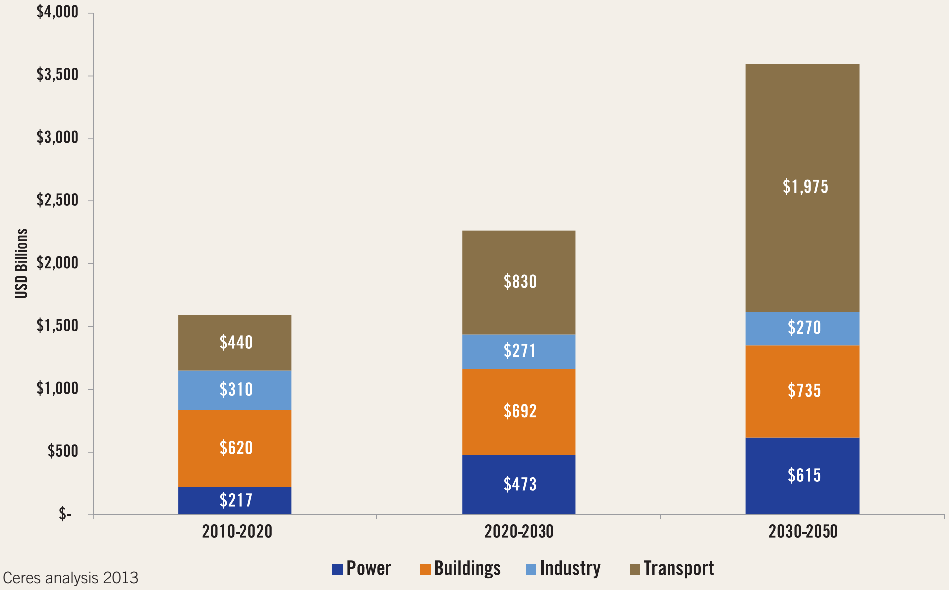


Source: IEA, Ceres analysis 2013

183 IEA, *Energy Technology Perspectives 2012: Pathways to a Clean Energy System*, 8. The IEA's scenario for 6 °C (6DS) of warming corresponds to atmospheric concentration of CO2 more than doubling by 2050 (relative to a 2009 baseline), which the IEA projects will happen should there be no strengthening of climate and clean energy policies from what was in place in mid-2013. The IEA's 6DS is generally consistent with the Current Policy Scenario in its 2013 *World Energy Outlook*. Note, however, that implementation of efficiency/renewable/fossil fuel reform/carbon prices measures already announced in 2013, but not yet implemented—as the IEA assumes in its New Policies Scenario—reduces future warming to for 3.6 °C, rather than 6 °C. IEA, *World Energy Outlook 2013*, 24.

Note, however, that the drivers of rising clean energy investment (i.e. replacement/retrofit of aging energy infrastructure in OECD countries and need for new infrastructure to meet surging energy demand in non-OECD countries) will exist to some extent irrespective of climate constraints; therefore to attain a 2 degree pathway *overall* investment in clean energy must be considerably higher than the numbers displayed above (averaging $1.5 trillion per year through 2020, and rising to $3.5 trillion per year by 2030).

FIGURE 19: OVERALL ANNUAL CLEAN ENERGY INVESTMENT IN A 2 DEGREE SCENARIO, 2010-2050 ($BN)



Source: IEA, Ceres analysis 2013

MEASURING THE CURRENT LEVEL OF CLEAN ENERGY INVESTMENT

Climate Policy Initiative

Measuring the current level of clean energy investment is challenging—a point we highlight in our Recommendation 4. That said, for 2012 the Climate Policy Initiative (CPI) calculates total investments devoted to climate mitigation as $337 billion. At least 88 percent of this (e.g. $297 billion) can be counted as "clean energy investment", including $265 billion for renewable energy generation, $32 billion for energy efficiency, and at least some portion of the $40 billion in "other mitigation measures" (i.e. the amount devoted to (1) process emissions in industry and fugitive emissions (e.g. industrial process improvements); and (2) sustainable transport modes supporting modal shift (e.g. rail, metro, etc.). Note, however, that since the CPI data does not include estimates of private investment for energy efficiency and "other mitigation measures", however, actual 2012 investment in the clean energy sectors covered by the IEA is likely to be higher than the CPI figures suggest.

TABLE 3: CPI CLIMATE FINANCE—BREAKDOWN INTO FINAL USES

	Private	Public	Total Climate Finance	Total %
Total Renewable Energy Generation	224	41	265	74%
- Solar	130	6	136	38%
- Wind	81	4	84.6	24%
- Biomass & waste	8	0.8	8.8	2%
- Biofuels	3	0.2	3.5	1%
- Small hydro	2	1	3.1	1%
- Other Technologies/Unclassified	NE	29	29	8%
Energy Efficiency	NE	32	32	9%
Other Mitigation Measures	NE	40	40	11%

Notes: Total does not equal 100 percent because excludes climate finance dedicated to adaptation. Energy efficiency includes (1) demand-side energy efficiency in buildings and industry (and transport if not modal shift, e.g. vehicles retrofit or replacement with efficient or electric vehicles); and (2) retrofit of transmission lines, distribution systems or substations to reduce energy use or losses. Efficiency improvements to fossil fuel-fired power plants are excluded. Other mitigation measures relevant to clean energy include (1) process emissions in industry and fugitive emissions (e.g. industrial process improvements); and (2) sustainable transport modes supporting modal shift (e.g. rail, metro, etc.)
Source: Climate Policy Initiative.

Bloomberg New Energy Finance

Another estimate of current clean energy investment comes from Bloomberg New Energy Finance (BNEF). BNEF figures are the most widely cited real-time estimate of investment into clean energy; BNEF data is also prized for breaking down total investment figures into specific asset classes.

Table 4 (next page) lists the sectors and asset classes that BNEF includes in its calculation of global clean energy investment. Broadly speaking, the sectors are similar to those for the IEA listed above. Comparing BNEF's estimate of actual clean energy investment to the IEA's forecast of required 2DS investment, however, requires adjusting the IEA and BNEF data sets in order to:

- remove from IEA data low-carbon sub-sectors that BNEF exclude from its data entirely, such as plane/ship/rail (which is easy enough to do).
- account for BNEF excluding from its data asset finance investment for building efficiency, industrial efficiency, and advanced transport (e.g. electric vehicles). This exclusion partly reflects data for certain sectors (i.e. building energy efficiency) lacking the quality and availability to allow for rigorous analysis. It can be problematic, however, as these sub-sectors account for a large share of IEA's overall required investment (and, as noted, IEA does not break its numbers down into asset classes as BNEF does). Including these sub-sectors in BNEF asset finance data would likely increase 2012 global clean energy investment well above $281 billion.
- consider whether all BNEF asset classes (e.g. R&D, M&A) should qualify as "investment" in the sense meant by the IEA forecasts, or whether this should be restricted to just those asset classes focused on *deployment* (e.g. asset finance, small distributed capacity, maybe some public markets and VC/PE).

Though extremely valuable, limitations of existing clean energy investment data underpin our call in Recommendation 4 for more rigorous and comprehensive data on clean energy finance

TABLE 4: COMPONENTS OF BNEF CLEAN ENERGY INVESTMENT STATISTICS BY SECTOR, AS AT Q2 2013

Service/Sector Group	Super Sector Name	Asset Finance	Public Markets	VC/PE	M&A	Re-Invested	SDC	Corp R&D	Gov R&D
Renewable Fuels	Biofuels	✓●	✓	✓•	✓•	✓		✓	✓
Renewable Power	Biomass & Waste	✓●	✓	✓•	✓•	✓		✓	✓
Renewable Power	Geothermal	✓●	✓	✓•	✓•	✓		✓	✓
Renewable Power	Marine	✓●	✓	✓•	✓•	✓		✓	✓
Renewable Power	Small hydro	✓●	✓	✓•	✓•	✓		✓	✓
Renewable Power	Solar	✓●	✓	✓•	✓•	✓	✓	✓	✓
Renewable Power	Wind	✓●	✓	✓•	✓•	✓		✓	✓
Other	General Financial & Legal Services		✓	✓•	✓•				
Other	Government & NGO		✓	✓•	✓•			✓	✓
Other	Services & Support (Clean Energy)		✓	✓•	✓•				
Other	Carbon Markets		✓	✓•	✓•				
Energy smart technologies	Advanced Transportation		✓	✓•	✓•				
Energy smart technologies	Digital Energy	✓	✓	✓•	✓•				
Energy smart technologies	Efficiency: Built Environment		✓	✓•	✓•				
Energy smart technologies	Efficiency: Industry		✓	✓•	✓•			✓	✓
Energy smart technologies	Efficiency: Supply Side		✓	✓•	✓•				
Energy smart technologies	Energy Storage	✓	✓	✓•	✓•				
Energy smart technologies	Fuel Cells		✓	✓•	✓•				
Energy smart technologies	Hydrogen		✓	✓•	✓•				
Other	Carbon Capture & Storage	✓•	✓	✓•	✓•			✓	✓
Conventional Power	Conventional Power								
Nuclear Power	Nuclear Power								
Transmission	Transmission	✓							
Water	Wastewater Treatment								
Water	Water Distribution								
Water	Water Risk Management								
Water	Water Smart Technologies								
Water	Water Storage								
Water	Water Treatment								

Renewable Energy
Clean Energy
Other

✓ Included in the standard clean energy investment output
✓ Partial inclusion in the standard clean energy investment output (in this case, coverage is for offshore wind transmission only)

● Included in the cross-border investment output
• Possibilty for inclusion in the cross-border investment output

Note: only completed deals with a 'new energy' relevance are included for Public markets, VC/PE, & M&A
Source: Bloomberg New Energy Finance

APPENDIX C

Actual & Target Financial Returns from Investments in Clean Energy

Target financial returns from investments in clean energy vary across asset classes, technologies, and geographies (and as with any investment, actual returns will often differ from target returns). Table 5 illustrates the high-level risk and return characteristics for different clean energy asset classes; the paragraphs below (1) assess how actual returns have compared with these expectations; and (2) address briefly how each of the 10 proposed Action Steps can improve risk-adjusted returns for clean energy investments.

TABLE 5: RISK/RETURN OVERVIEW OF CLEAN ENERGY ASSET CLASSES

	Infrastructure	Fixed Income	Public Equity	Private Equity/Venture Capital
Description	Ownership of infrastructure assets	Debt securities issued by projects, banks, MDBs, & corporations	Publicly-traded equity securities issued by corporations	Earlier-stage investment in private companies
Risk	Med	Low	Med	High
Target Return	12-18 percent (direct) 7-20 percent (fund)	1-6 percent (climate bonds) 3-10 percent (project, ABS)	5-20 percent	20-30 percent
Volatility	Low	Low	High	Low
Liquidity	Low/Med	Med/High	High	Low
Vehicles	Direct, Fund (Private or Listed), Yieldcos	Project Bonds, ABS, Climate Bonds	Direct, Fund	Direct, Fund

Note: Infrastructure here refers only to equity investment vehicles; infrastructure-related debt vehicles (e.g. projects bonds, ABS, and climate bonds) are included in Fixed Income.
Source: DB Climate Change Advisors, OECD, Ceres analysis 2013

Note that an analysis more sophisticated than that in the table above would vary investment horizon and target return by type of investor. For example, for the case of US solar investment, Table 6 (next page) categorizes the investment preferences of different kinds of investors.

ACTUAL RETURNS VS. TARGET RETURNS

Infrastructure

A recent OECD survey reported actual returns (measured by internal rate of return) for direct clean energy project investments in a range of -13-21 percent; relative to target returns of 12-18 percent, this suggests that direct project investments have often (but not always) met expectations.[184] Assessing how frequently target returns have been met is difficult owing to a paucity of public data, a point discussed in Action Step 4.

Relative to direct project investments, more extensive data on the performance of infrastructure *funds* helps to more accurately compare target and actual performance. For the period 2004-2011, Cambridge Associates analyzed 123 investments in renewable power development (with a combined paid-in capital of $7.4 billion) made by 109 private equity funds.[185] For these investments Cambridge Associates calculates a “gross pooled IRR” of 11.1 percent and a “net-to-limited partner” fund-level IRR of roughly 7 percent (i.e. equal to the low end of target returns for such investments). This match between actual and (low-end) target returns strengthens the case for at least the renewable energy portion of clean energy infrastructure funds being able to add value to investor portfolios.

184 Kaminker, C. et al., “Institutional investors and Green Infrastructure Investments: Selected case Studies,”30. Note, however, that projects where a large portion of investor returns derive from tax incentives (e.g. wind and solar projects in the US) place tax-exempt entities such as public pension funds and endowments at a considerable disadvantage. This underscores the need to rethink incentives for clean energy with the goal of attracting more institutional capital, as discussed in Action Step 10.

185 Cambridge Associates LLC, “Clean Tech Company Performance Statistics”, March 31, 2013, http://www.cambridgeassociates.com/pdf/Cambridge percent20Associates percent20Clean percent20Tech percent20Company percent20Performance percent20Statistics percent203 percent2031 percent2013 percent20 percent282 percent29.pdf.

TABLE 6: CHARACTERISTICS OF DIFFERENT KINDS OF INVESTORS

	Investor type	Examples	Preferred asset classes	Investment horizon	Targeted returns[a]
← Low returns / low risk – High returns / high risk →	Venture capital	• Accel Partners • Sequoia Capital	• Early-stage companies and platforms	• ~10 years (fund life) • ~3-5 years (exits for individual investments)	• >30%
	'Development' private equity	• KKR • Starwood Energy	• Infrastructure projects • Portfolios of projects	• ~7-10 years (fund life)	• ~10-20%
	Infrastructure debt funds	• Hadrian's Wall • Macquarie Group	• Direct infrastructure loans • Infrastructure debt securities	• ~20 years	• ~8-11% (low risk/operational projects) • ~11-15% (low/medium risk primary deals)
	Hedge funds	• Bridgewater • Soros Fund Mgmt	• Liquid securities	• ~1 year	• ~7-10% for absolute return funds • Maximise returns (~20%+) for aggressive funds
	Banks	• JP Morgan • US Bank	• Currently: project finance (construction and term debt), tax equity • Future: construction finance, tax equity	• Debt: – Historically: >10 years – Currently: 5-10 year semi-perms • Tax equity: 5-10 years	• >7% (overall company earnings) • ~2.5-3% debt spreads over three month LIBOR[b] • ~7-8% tax equity after-tax yield for utility-scale PV, ~9% for distributed portfolios (unlevered), 14-18% (levered) • >14% for tax equity structures favouring IRR over NPV
	Large corporations	• Apple • Chevron	• Cash • Short-term commercial paper and notes • Liquid, low-risk tax credits	• <1 year for >50% of fixed income on balance sheet • ~1-5 years for most other fixed income holdings • Corporate minority equity holdings	• >7% (overall company earnings) • >LIBOR for fixed income holdings • >8% for tax equity (eg, low-income housing)
	Mutual funds / Retail investors	• Fidelity • T Rowe Price	• Liquid securities	• Quarterly, for some • ~1-2 years, for others • ~10+ for retirement portfolios	• ~6-8%
	Pension funds / Endowments	• National Pension Service of Korea • New York State Teachers • Yale Endowment	• Various: willing to invest in managers (sometimes directly) across broad range of asset classes – eg, venture capital, equities, real estate	• Annual (liability matching framework: ensure yearly liabilities are met) • 'Perpetuity' for overall fund lifetime	• ~7-8%
	Utilities	• Constellation • Tri-State G&T Coop	• Power plants	• Quarterly (overall company earnings) • >20 years (asset lifetimes)	• ~11% required return on equity • ~5–6% WACC • ~4% dividend yield
	Insurance companies	• AIG • Prudential	• Fixed income to cover claims • Riskier assets to grow asset base	• >20 years (long-term assets)	• ~6% (long-term) • Maximise return
Other stakeholders	Vendors / EPC installers	• Bechtel • Trina Solar	• Pipelines / channels for their products	• ~3-5 years (companies looking to ensure future sales of their products)	• ~2.5-3% debt spreads over three-month LIBOR[b]
	Landowners / Real estate developers	• Ted Turner • Vornado	• Land, buildings	• ~10 years (fund lifetime) • >20 years (for individual holdings)	• ~20-25% (development) • ~5% REIT dividend yield
	Government	• California PUC • US Treasury • US Army	• Projects	• Long term	• n.a.

Source: Bloomberg New Energy Finance

Fixed Income

Returns from fixed-income investments related to clean energy tend to be both lower and less volatile than for equity investments in clean energy infrastructure; exact returns, however, vary across different fixed-income vehicles.[186]

Across the $4.1 billion in privately placed clean energy project bonds since 2011, these bonds have had average annual coupons (i.e. interest payments) between 4-4.5 percent, or 200-250 basis points (2-2.5 percent) above 10-year yields on US Treasury notes.[187] Bonds from several very large projects, however, have offered somewhat higher yields. For example, to finance a portion of the 550-megawatt Topaz solar PV farm in Southern California, in February 2012 TopazSolar Farms LCC (owned by Warren Buffett's MidAmerican Energy Holdings) issued $850 million in 27.5 year bonds that pay a coupon of 5.75 percent (or 379.7 basis points above US Treasury notes of similar maturity). Strong investor demand for such bonds has compelled MidAmerican to pursue similar offerings for other large-scale solar PV projects that it has purchased.

Though it is very early days, initial issues from asset-backed securities related to clean energy are offering coupons similar to those discussed above, with SolarCity's November 20132 $54.4 million issue (tied to its residential and commercial rooftop solar leases) paying a 4.8 percent annual coupon.[188]

Relative to yields on ABS and project bonds, yields have been somewhat lower for "climate bonds" issued by corporations to fund specific low-carbon activities. For example, Bank of America's recent $500 million issue of three-year bonds to finance loans to energy efficiency and renewable energy projects carries an annual coupon of 1.35 percent, or only 80 basis points above three-year US Treasury notes.[189]

Finally, yields have been lowest on AAA-rated climate bonds issued by the World Bank and other multilateral/national development banks (with recent three-year issues from the World Bank paying annual coupons only 4-15 basis points above three-year US Treasury Notes).[190] Such instruments do, however, offer at least marginally higher yields at a risk level comparable to that on US Treasuries.

Public Equity

Relative to infrastructure and fixed income, the recent performance of clean energy-related public equities has been challenging. Figure 20 (next page) illustrates clean energy indices over the past five years (i.e. composites of the largest publicly-traded clean energy companies) to have both significantly underperformed the broader market and exhibited nearly 75 percent more volatility. That said, over the last year this picture has changed considerably, with clean energy indices delivering twice the returns of the broader market and several clean energy companies (chiefly Tesla and SolarCity) being among the fastest-growing stocks of 2013. Though clean energy companies will likely continue to exhibit the above-average volatility characteristic of technology-related stocks broadly, the medium-term outlook for clean energy public equity is improving as a result of (1) progress on a long-overdue contraction of supply in solar and wind manufacturing; and (2) continued expansion of the clean energy universe beyond just pure-play wind and solar companies (e.g. into building energy efficiency, LEDs, etc.).

186 The discussion below focuses on the yield of different fixed income instruments related to clean energy. A comprehensive discussion of performance would also assess default rates of these instruments; very recent issuance dates, however, precludes an accurate examination of default rates for most of the instruments in question. As these issues reach maturity a more informed examination of default rates will be possible.

187 Bloomberg New Energy Finance, "Green Bonds Market Outlook 2013: Ripe pickings at the green bond market", 2013.

188 Justin Doom, "SolarCity Advances on First Solar-Bond Sale, Upgrade," Bloomberg News, November 14, 2013, http://www.bloomberg.com/news/2013-11-14/solarcity-advances-after-54-million-bond-sale-upgrade.html.

189 Climate Bonds Initiative, "Bank of America closes their own 3yr, Baa2, $500m green bond—a US first", November 20, 2013, http://www.climatebonds.net/2013/11/bank-of-america-closes-their-own-3yr-baa2-500m-green-bond-a-us-first/

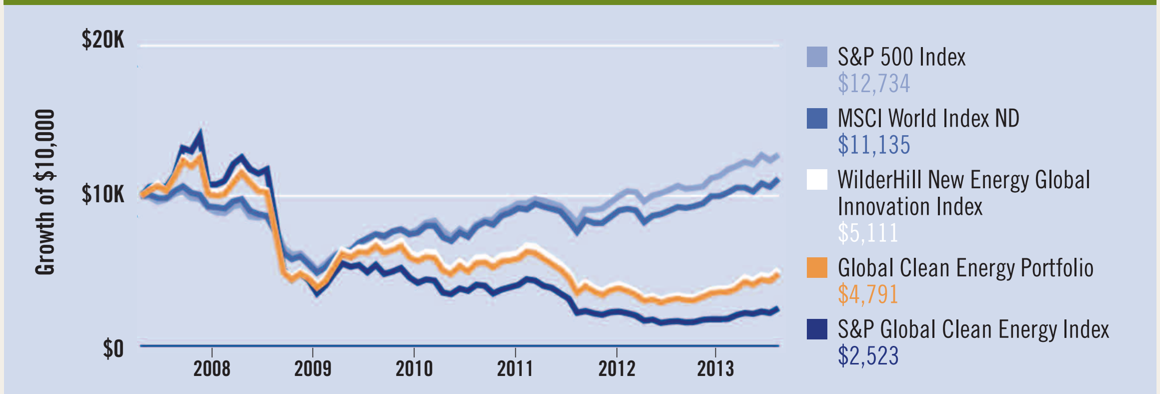
190 Ibid.

Private Equity/Venture Capital

Similar to the case for public equities, private equity/venture capital investments in clean energy companies have (with notable exceptions) so far often fallen short of expectations. Analyzing 1,100 investments in 652 companies ($15.4 billion in paid-in capital) across 409 funds from 2000-2011, Cambridge Associates calculates the "gross pooled IRR" of such investments to range from 0.8 percent for renewable power manufacturing companies to 5.4 percent for "energy optimization" companies (i.e. building efficiency, LED, smart grid, and advanced transport); using the same adjustment as above, this suggests net-to-investor IRRs of -3.6 percent to 1 percent (a far cry from 20-30 percent target returns).[191] Focusing just on private equity, however, does brighten the picture somewhat, with Preqin reporting in 2012 5 of 24 leading "green" private equity funds to have delivered fund-level net IRRs above 10 percent.[192]

Early disappointments aside, however, there is reason to be optimistic about the prospects for successful VC/PE investments going forward. This is due not only to the progress on breakthrough advances (e.g. via use of graphene and other advanced materials), but also to what one analyst terms the "steady, iterative advancement of products and services that improve the efficiency, waste profile and manufacturing cost of existing analogs, but are not market disruptors… from cheaper, more efficient lighting to advanced heating software."[193] Investors who finance such advancement now are likely to reap significant gains in the years ahead.

FIGURE 20: PERFORMANCE OF CLEAN ENERGY PUBLIC EQUITIES RELATIVE TO BENCHMARKS, 2007 - SEP 2013



Note: Data beginning at fund inception and ending Sept. 30, 2013. Source: Invesco PowerShares.

HOW EACH OF THE 10 RECOMMENDATIONS CAN IMPROVE RISK-ADJUSTED RETURNS FOR CLEAN ENERGY INVESTMENTS AND PORTFOLIOS

1. Develop capacity to boost clean energy investments and consider setting a goal such as 5 percent portfolio-wide clean energy investments

The heightened commitment resulting from a portfolio-wide goal would give investors the best chance of capitalizing on new clean energy energy-related opportunities across all asset classes (e.g. including fixed income), as opposed to relegating this theme to just public equity or venture capital. Bolstering capacity for infrastructure investment will strengthen the potential to pair the cash flows of clean energy infrastructure assets with investor liabilities and funding requirements. Note, however, that both materially increasing clean energy investments and development of in-house expertise will depend on each individual investor's ability to identify suitable opportunities across asset classes that meet their criteria for returns, liquidity, etc.

191 Cambridge Associates LLC, "Clean Tech Company Performance Statistics," 8.

192 Preqin, "2012 Global Private Equity Report, 2012." "Green" private equity firms include those investing in one or more of the following sectors: clean technology, environmental services, and renewable energy.

193 Dallas Kachan & Danielle Fugere, "Cleantech Redefined: Why the next wave of cleantech infrastructure, technology, and services will thrive in the twenty first century," October 2013, http://www.asyousow.org/health_safety/cleantech-redefined.shtml

2. Elevate scrutiny of fossil fuel companies' potential carbon asset risk exposure

In a 2011 report Mercer concluded that climate policy risk (of which carbon asset risk is a part) may account for 10 percent of overall risk in investor portfolios over the next 20 years. Moreover, the potential for reduced demand for fossil fuels driven by factors other than climate policy action (e.g., increased renewable energy, energy efficiency, fuel switching, etc.) could significantly affect fossil fuel pricing and company valuations. Investors should be boosting attention to carbon asset risk by engaging with fossil fuel companies on the potential of high cost, high carbon fossil fuel reserves becoming "stranded," thus creating long-term risks to portfolios.

3. Engage portfolio companies on the business case for energy efficiency and renewable energy sourcing, as well as on the financing vehicles to support such efforts

Encouraging companies to aggressively pursue energy efficiency opportunities can help to unlock projects with high return on invested capital, thereby creating shareholder value. Moreover, in using clean energy resources to minimize carbon emissions companies will (1) reduce vulnerability to future carbon regulation (thereby protecting against future cost increases); and (2) possibly identify new business opportunities or customer solutions (thereby increasing future revenues). Both of these reasons underpin the conclusion of academic research that, over the long term, companies with leading environmental performance tend to also deliver superior financial returns for investors.[194]

4. Support efforts to standardize and quantify clean energy investment data and products to improve market transparency

Standardizing definitions of key investment terms (e.g. what constitutes a "climate bond") will minimize the due diligence burden on investors and reduce the transaction costs of investing in newer clean energy-related products. Similarly, by reassuring potential buyers about what they are purchasing, standardization will increase the liquidity of climate bonds and other products. More data on clean energy investment generally will enable more precise benchmarking and evaluation of potential deals.

5. Encourage "green banking" to maximize private capital flows into clean energy

Expanded issuance of climate bonds by multilateral banks will expand the universe of highly-rated fixed-income products attached to clean energy, thereby making it easier for investors to increase allocations to clean energy within existing liquidity/creditworthiness constraints. Similarly, credit enhancement for project bonds will enable investors to capture the relatively higher yield of these instruments (relative to sovereign debt) while protecting against downside risk that results from a lack of historical data. Finally, the $2.5 trillion covered bond market offers attractive products for pension funds and insurers—extra yield relative to sovereign debt, but with less risk than unsecured bank debt or asset-backed securities—and extending this market to clean energy will increase opportunities for covered bonds in investor portfolios.

6. Support issuances of asset-backed securities to expand debt financing for clean energy projects

Asset-backed securities for energy efficiency and renewable energy projects offer long-term, low-volatility yields that match well with the liabilities of insurers and pension funds. To reach a scale that is attractive to these investors, however, this market must overcome the growing pains common to any new capital markets product. The initiatives in this recommendation will (1) minimize the due diligence burden on buyers of clean energy ABS issues (by standardizing PPA terms); (2) make future cash flows from such issues more stable (by strengthening the supply of O&M providers to keep systems in service); (3) enable more accurate rating and pricing of such issues (via more detailed historical data); and (4) limit downside risk for buyers of early clean energy ABS issues (via credit enhancement from banks). For investors participating in such initiatives will be a down payment on the extra-yield they can reap in the future.

194 DB Climate Change Advisors, *Sustainable Investing: Establishing Long-Term Value and Performance*, May 2012, https://www.dbadvisors.com/content/_media/Sustainable_Investing_2012.pdf

7. **Support development bank finance and technical assistance for emerging economies**

By reducing sovereign risk, expanded risk insurance for clean energy investments in developing countries removes a key red flag on otherwise attractive investments. More generally, one the knock-on effects from helping emerging economies to embrace a low-carbon future is that such economies are (particularly in the case of the power sector) more likely to open new investment opportunities to outside sources of capital (note that development bank financing creates $3-15 of private investment opportunity for every $1 of public funds deployed).

8. **Support regulatory reforms to electric utility business models to accelerate deployment of clean energy sources and technologies**

With a combined enterprise value of trillions of dollars, relatively low volatility and predictable earnings, the debt and equity of electric utilities has long held a significant share of institutional investor portfolios. Many trends, however, are eroding the viability of traditional utility business models. As stewards of trillions of dollars of capital, investors have a strong interest in ensuring that electric utilities remain viable investments. Supporting utilities' transition to new, more sustainable business models will preserve the electric utility sector as a viable place for investors to put their capital to work.

9. **Support government policies that result in a strong price on carbon pollution from fossil fuels and phase out fossil fuel subsidies**

Climate change has the potential to harm long-term investor returns via (1) actual physical impacts (e.g. heat waves, storms, etc.) that can severely damage individual companies and slow the growth of entire economies;[195] and (2) implementation of policies to restrict carbon emissions, which, especially if delayed for another decade or so, may come as a drastic and abrupt shock to company business models and economies at large. Adoption of economy-wide carbon prices now helps to prevent both of these risks, and enables investors to plan prudently for the transition to a low-carbon future. More broadly, adoption of carbon prices and removal of fossil fuel subsidies will create tailwinds across all asset classes for low-carbon investments and headwinds for high-carbon investments such as oil and gas production.

10. **Support policies to de-risk clean energy deployment**

Policies that provide stable, long-term cash flows to clean energy projects that do not depend on complicated tax incentives will (perhaps more than anything) compensate for manifold risks of such projects and make them attractive to the institutional investors of all stripes. Moreover, a focus on large-scale deployment will create investment opportunities of the size necessary for investors to justify building expertise in a new area. Finally, inasmuch as deployment lowers the costs of clean energy technologies to be competitive with conventional energy sources, further opportunities for investment will arise that are capable of taking in trillions of dollars of institutional capital.

195 Stern, N. Nicholas Herbert, ed. *The Economics of Climate Change: the Stern Review.* Cambridge University Press, 2007.

APPENDIX D

Key Market Consideration

IMPACT OF BASEL III, SOLVENCY II, AND OTHER FINANCIAL REGULATIONS ON CLEAN ENERGY INVESTMENT

a. Impact of Basel III bank liquidity requirements

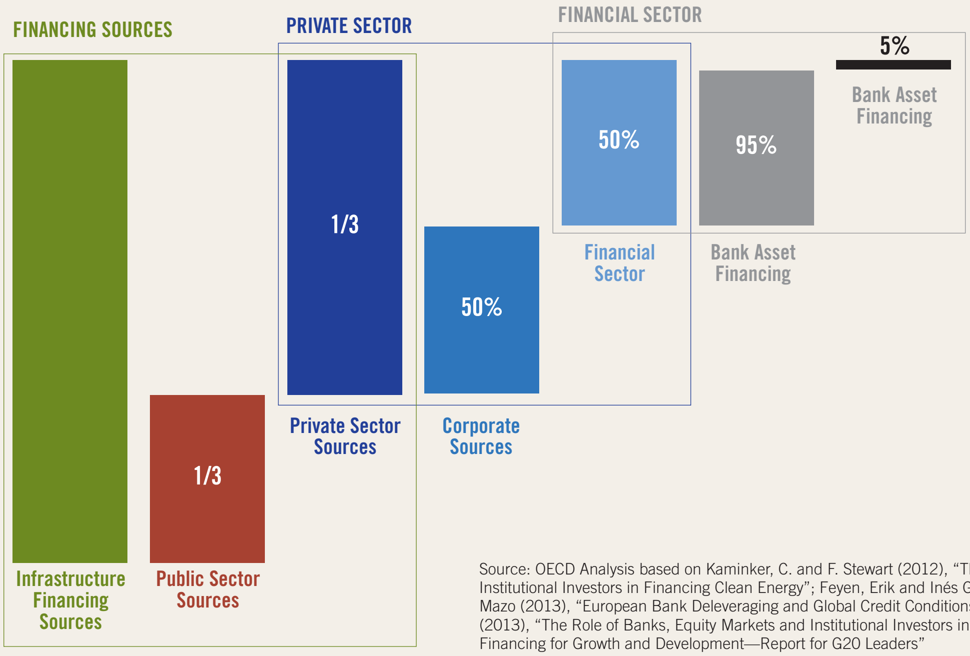
b. National regulations that prohibit pension fund investment in infrastructure

c. Solvency II and other risk-based solvency regulations

BASEL III LIQUIDITY REQUIREMENTS

Though clean energy projects must begin to access the bond market via such instruments as covered bonds and asset-backed securities, through at least 2020 a more old-fashioned source of debt—bank loans—will continue to play a key role in financing clean energy investment. Bank loans, usually in the form of long-term, non-recourse project finance,[196] currently provide about 1/3 of clean energy asset finance (in 2012 roughly $50 billion of non-recourse project finance, out of $140 billion of total clean energy asset finance).[197]

FIGURE 21: LANDSCAPE OF INVESTMENT FINANCING SOURCES FOR GREEN INFRASTRUCTURE IN OECD COUNTRIES (ILLUSTRATIVE EXAMPLE)



Source: OECD Analysis based on Kaminker, C. and F. Stewart (2012), "The Role of Institutional Investors in Financing Clean Energy"; Feyen, Erik and Inés González del Mazo (2013), "European Bank Deleveraging and Global Credit Conditions"; OECD (2013), "The Role of Banks, Equity Markets and Institutional Investors in Long-Term Financing for Growth and Development—Report for G20 Leaders"

196 Project finance loans are characterized by long tenors (from 10 years up to 40 years in some cases) and are serviced by income-generating assets that may not have a ready secondary market during an economic shock.

197 Angus McCrone, "Clean Energy: Green Shoots of Institutional Investment," 2.

New regulations on bank liquidity undertaken in response to the 2008-9 financial crisis, however, are causing banks to curtail lending to infrastructure projects, including renewable energy projects. Specifically, implementation of the global Basel III Accord's new bank liquidity requirements[198] may reduce loan tenors, increase interest rates, and ultimately drive up the cost of financing for clean energy. Such requirements are intended to ensure that banks always have sufficient liquid assets[199] on hand to enable them to withstand periods of market stress (i.e. a "run on the bank"). The Basel III "Liquidity Coverage Ratio" (LCR), for example, stipulates that banks must have a reserve of "high quality liquid assets" sufficient to cover 30 days of estimated cash outflows during a period of market stress. Loans to renewable energy and other infrastructure projects, however, do not help banks to meet their LCR thresholds. To make room for additional holdings of assets that do count toward LCR thresholds, banks are selling off project finance loans and reducing the supply of capital for renewable energy developers.

Another relevant portion of Basel III is the Net Stable Funding Requirement (NSFR), which requires banks to fund a greater proportion of their illiquid, long-term assets—such as loans to renewable energy projects—with longer-term sources of funding such as Eurobonds and customer deposits. Since longer-term funds are more expensive, however, this requirement is causing banks to (1) charge higher interest rates for long-term loans, increasing debt costs for renewable energy projects; and/or (2) shorten loan durations (for example, making 5-10 year loans instead of 10-15 year loans). Shorter loan tenors introduce risk such as whether a project will be able to refinance when its initial loan expires. Since cash flows from a project will be used to repay debt before giving any returns to equity investors, uncertainty about the cost of debt over a project's lifetime creates greater risk for equity investors (who typically fund at least 20 percent of renewable energy projects). This added risk increases the required return for equity capital, thus further increasing the overall financing cost for renewable energy projects.

Though implementation of Basel III is just beginning (and will stretch from 2013-18), its impacts of on lending to renewable energy projects are already becoming clear, especially for European banks,[200] the dominant lenders to renewable energy projects. To rectify an expected shortfall in long-term liquidity under Basel III of EUR 2.3 trillion,[201] European banks have already unloaded over $11 billion in project finance loans (often at discount prices) to U.S. and Japanese banks.[202] Tenors on project finance loans are also shrinking from 10-15 years to 5-10 years. This contraction in the supply and duration of available bank debt threatens to drive up financing costs for renewable energy projects. Since the dominant renewable energy generating technologies, such as wind and solar, require high upfront costs, any increase in the cost of long-term debt finance will undermine project economics.[203]

Perhaps most challenging is that—by diminishing the portion of bank balance sheets that can be allocated to asset-backed securities—Basel III may discourage banks from securitizing portfolios of loans to renewable energy projects. Since securitization is a key long-term solution to scaling up renewable energy investment, implementation of Basel III may cause short-term pain (as banks curb project finance lending) and also delay progress toward the long-term goal of connecting renewable energy projects with capital markets.

198 Basel Committee on Banking Supervision, "Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools," Bank for International Settlements, January 2013, http://www.bis.org/publ/bcbs238.pdf

199 "Liquid assets" can be sold (hence converted into cash) quickly and easily without the seller being forced to accept major reductions in price.

200 Though the above discussion emphasizes the impacts of Basel III implementation in Europe, note that regulators in the US and China are also fully implementing the Basel III requirements. For example, a recent report from the Bank of International Settlements (BIS)—the organization responsible for overseeing creation of Basel III—found China's implementation of the Basel capital framework to be closely aligned with the Basel III global standards. Basel Committee on Banking Supervision, "Regulatory Consistency Assessment Programme (RCAP) Assessment of Basel III regulations—China," Bank for International Settlements, September 2013, http://www.bis.org/bcbs/implementation/l2_cn.pdf

201 Michael Liebrich and Angus McCrone, "Financial Regulation—Biased Against Clean Energy and Green Infrastructure?," *BNEF Clean Energy White Paper,* February 20, 2013, http://about.bnef.com/white-papers/financial-regulation-biased-against-clean-energy-and-green-infrastructure/

202 Travis Lowder's blog, "Who's Afraid of Basel III," US National Renewable Energy Laboratory, August 13, 2012, https://financere.nrel.gov/finance/content/whos-afraid-basel-iii.

203 Michael Liebreich and Angus McCrone, "Financial Regulation—Biased Against Clean Energy and Green Infrastructure?," 1.

NATIONAL REGULATIONS THAT PROHIBIT PENSION FUND INVESTMENT IN INFRASTRUCTURE

Pension funds in many countries face a barrier to clean energy infrastructure investment that is more fundamental than most of the issues discussed in this paper—regulations that prohibit investment in infrastructure outright. For example, Indonesia's civil servants pension fund (Jamsostek) and nearly all public pension funds in China (with the exception of the National Social Security Fund) are barred from investing in infrastructure. Nor is the issue of regulatory obstacles to infrastructure investment relevant only to emerging markets; for example, many EU countries also proscribe their pension funds from allocating money to infrastructure.

Though regulations on pension investment in infrastructure usually aim to serve legitimate purposes (e.g. preventing pension funds from becoming piggy-banks for government-backed infrastructure projects), they often also are excessive and increasingly unnecessary over time as pension fund fiduciaries become more professional and independent from political meddling. Reforming such regulations will often be necessary to increase institutional allocations to clean energy infrastructure (particularly in developing countries), and is an issue that will have to be reckoned with on a country-by-country basis.

SOLVENCY II AND OTHER RISK-BASED SOLVENCY REGULATIONS

Even for investors allowed to invest in infrastructure, financial regulations still pose considerable challenges to investing in projects related to clean energy (whether via direct or semi-direct means). In a recent BNEF poll of 65 senior institutional investors, asset managers, bankers, utility executives, project developers, and policymakers, 35 percent of respondents cited financial regulation issues as "the most important issue deterring institutions from making investments in clean energy projects" in Europe.[204] Chief among these issues are proposed "risk-based solvency regulations" (e.g. Solvency II) that limit the ability of funds to use infrastructure assets to balance their liabilities.

Focusing on the European Union, Solvency II—often described as "Basel for insurers"—is an EU directive that that seeks to lower the risk exposure of European insurance companies by imposing higher capital requirements.[205] The directive specifies different capital requirements depending on the perceived riskiness of asset in insurers' portfolios, with such assets being "marked-to-market" to determine their fair value. To be implemented for insurers beginning in 2014, the risk-based solvency rules at the core of Solvency II are increasingly being applied to European pension funds as well.

Analysts have observed that new solvency requirements may deter investment in longer-term and less liquid assets such as infrastructure, including clean energy infrastructure.[206] For example, on the debt side, higher capital charges for bonds of longer tenors and/or lower credit ratings may discourage investment in multilateral development bank "climate bonds", clean energy-project bonds, and the like in favor of AAA-rated, short-term government bonds - thus crimping the ability to ramp up bond market finance of clean energy. On the equity side, critics argue that proposed capital requirements for infrastructure investments are too high relative to the risk of the underlying assets[207]—again, with the impact being to discourage investment in renewable energy projects.

204 Angus McCrone, "How to Attract New Sources of Capital to EU Renewables," *BNEF Clean Energy White Paper,* December 9, 2013, http://about.bnef.com/white-papers/how-to-attract-new-sources-of-capital-to-eu-renewables/

205 European Insurance and Occupational Pensions Authority, "Solvency II," https://eiopa.europa.eu/en/fixed-width/activities/insurance/solvency-ii/index.html, accessed December 23, 2013.

206 Kaminker, C. et al., "Institutional Investors and Green Infrastructure Investments: Selected Case Studies," 46-48.

207 Kaminker C. and F. Stewart, "The Role of Institutional Investors in Financing Clean Energy," 32 notes that "the proposed Solvency II regulation would likely require a 49 percent stress test (i.e. would the insurer still be able to meet its liabilities if these assets declined by this amount) for infrastructure equity and private equity (compared to a capital charge of 39 percent for listed equity) and 25 percent for real estate and infrastructure debt (NB this compares with a 0 percent capital charge for European government bonds—whatever their credit rating)."

IMPACT ON RISK AND RETURN OF CLEAN ENERGY INVESTMENTS

Infrastructure (including that related to clean energy) can offer investors extra yield (relative to core fixed-income) with low volatility and cross-correlation (relative to public equity). Removing or reducing barriers to investing in infrastructure—whether in the form or outright prohibitions or excessively high capital requirements—may therefore expand possibilities to capture higher risk-adjusted returns. As to bank liquidity, ensuring continued bank lending to clean energy projects will preserve the debt slice of the capital stack, reduce refinancing risk, and help clean energy infrastructure projects to deliver attractive equity returns to investors. Regulators therefore ought to consider how to reconcile stronger liquidity requirements with continued bank lending to clean energy. To the extent that new bank liquidity requirements diminishes conventional bank lending to renewable energy projects, this heightens the need to scale up alternative sources of debt finance such as project bonds, covered bonds, and asset-backed securities.

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